Welding Engineer

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JUNE, 1957

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Welding Engineer

JUNE. 1957
VOL. 42—No. 6

THE MAGAZINE OF JOINING
AND SEVERING OF MATERIALS

America's Pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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TIG WELDING . . .

Tig—for the metals that "couldn't be welded" ... 32
Jack Fairlie
Data Sheet No. 201: *Current selection for Tig welding* ... 35
Should Tig welds be backed up? ... 37
Speed and ease mark the use of a new Tig gun ... 38
Edens, Schumbacker, Wilson and Murock
Joint designs for Tig welding ... 41
Stainless jugs are Tig welded ... 43
Tig and magnesium . . . allies in design for strength ... 44
Jack Fairlie

SHIPBUILDING

Welding turns out a rugged houseboat ... 74
F. T. Tancula

FABRICATION

Ford spot welds first aluminum truck for the Army ... 46
Trouble spots go out when welded track goes in ... 56
George Polk
Automatic Mig for drive shafts ... 62
Resistance welded gasket tubes ... 66

JOB SHOP

Septic tank forms are arc welded ... 70

OPERATION

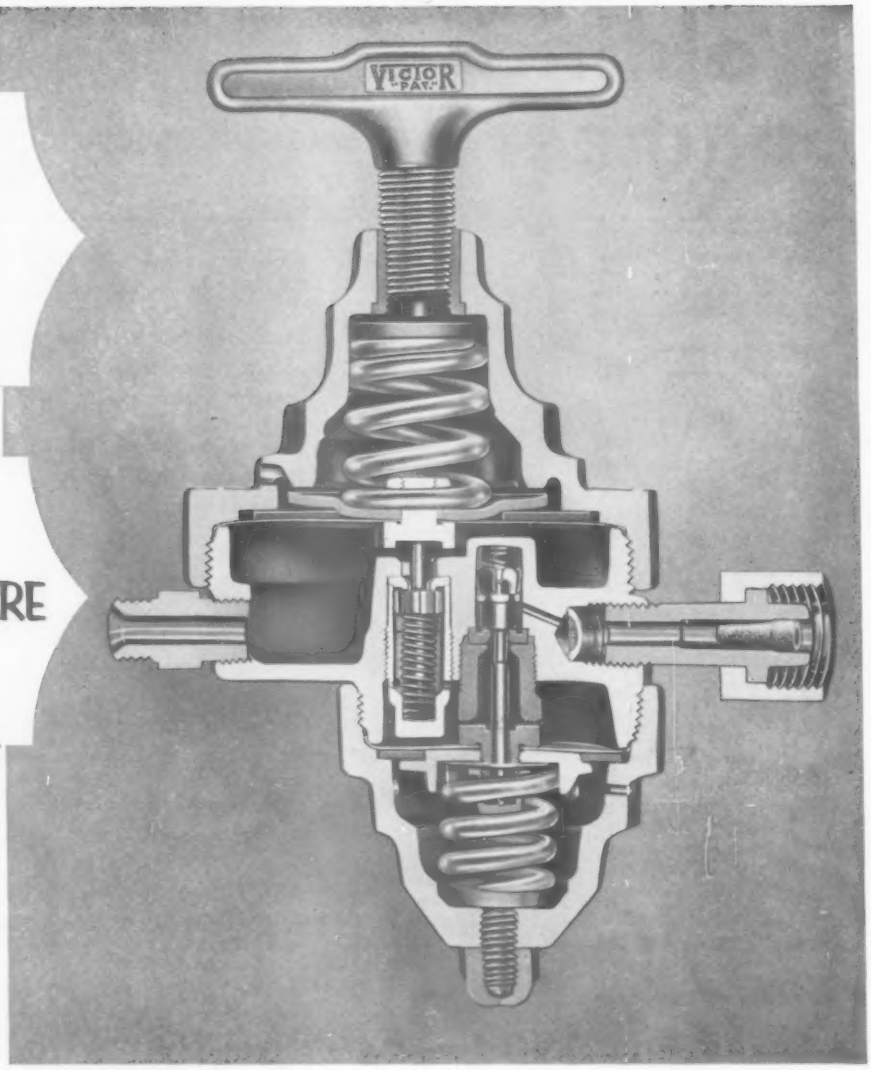
Field tests are still best for hardfacing ... 52
D. B. Rankin
Prison school for weldors ... 54
Gerald L. Crofton

DEPARTMENTS

News ... 5
Letters to the editor ... 8
30 years ago ... 9
Your WeldWorld at press time ... 13
Between Passes ... 23
Editorial: *Welding's "current textbook"* ... 29
Data Sheet No. 201: *Current selection for Tig welding* ... 35
The Welding Clinic: *Removing weld discolorations on stainless* ... 60
On the job ... 78
New products ... 80
Coming events ... 106
People ... 107
The Welding Shopper ... 111
Free Literature ... 112
Advertisers in this issue ... 113
Literature offered in ads ... 114
Welding Info-Aids ... 115

The man on the job prefers **VICTOR** Safety Regulators

THIS INSIDE PICTURE TELLS WHY



Cut-away of Model VTS400 series 2-stage Safety Regulator. Victor makes regulators for almost every gas and use, for pressures to 10,000 p.s.i., and volumes to 28,000 c.f.h.

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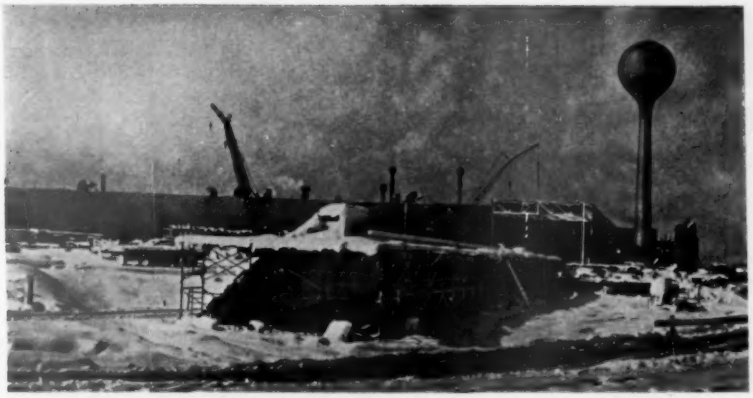

CONSTRUCTION on addition to Lincoln plant was underway when blizzard hit Cleveland. About this time of year, snow looks cool and refreshing, doesn't it? (See story below.)

LIQUID air removes moisture from exhaust equipment used to produce vacuum in electronic tubes. (See story below.)

News

Lincoln adds floor space

An $8,500,000 addition to its present five-year-old plant is now being built by the Lincoln Electric Co., Cleveland. Capacity is being added to both electrode and machine divisions to supply the rapidly expanding welding market.

The building will have under one roof, on one floor, almost 30 acres. The new production facilities will also include storage space. Austin Co. is the builder of the plant and its new addition.

Canada forms IIW council

Canadian members of the International Institute of Welding have formed a council to direct the affairs of the Institute and its Commissions in Canada.

Founded in 1948 to promote and encourage the development of welding, the international body also provides for exchange of scientific and technical information and assists in formulation of international standards for welding. The latter is done in cooperation with the International Standards Organization.

Canadian membership in the IIW is shared by the Canadian Welding Bureau, Canadian Welding Society and the Department of Mines and Technical Surveys. The newly formed council will act as a joint instrumentality for the sponsor bodies.

Delegates for 1957 to the Canadian Council are W. P. Campbell, R. A. Dunn, H. J. Nichols, W. R. Stickney (executive secretary), R. M. Gooderham and E. A. Gill.

All-State opens western warehouse

Southern California and the surrounding areas are now being served by a western warehouse recently opened by All-State Welding Alloys Co., Inc., at 4933 Firestone Blvd., South Gate, Calif.

The new facility stocks the complete list of All-State's product lines of alloys and fluxes for welding, brazing, soldering, tinning, and cutting.

It is under the direction of Harry Peacor, regional manager, and Robert Comstock, senior warehouseman.

WE is moving!

As you read this, *WE* shall be moving to a suburb north of Chicago. Welding Engineer Publications, Inc., henceforth will be located at 5826 Dempster St., Morton Grove, Ill.

Amperex cuts liquid air costs

Liquid air is an important commodity around many industrial plants today where temperatures as low as —328 deg F must be maintained for routine processes and test procedures.

Amperex Electronics Corp., Hicksville, N. Y., manufactures a wide variety of power and special-purpose electron tubes for resistance welding. In this work, liquid air plays a vital role in thousands of tubes every week.

Last summer the company installed a Norelco gas liquefier, a new machine which is only 37 in. long, 20 in. wide and 34 in. high. The unit is powered by a 10-hp motor and requires cooling water either from a recirculating cooler or from city mains. In operation, the machine produces more than 5 quarts of liquid air per hour.

Before acquiring the gas liquefier, Amperex purchased 500 quarts of liquid air each week from outside suppliers at a cost of 50 cents per quart. (In more remote locations, the price is often much higher.)

A full year, 50 weeks, of manufacturing operation required 25,000 quarts of liquid air and this represented an annual operating expense of $12,500. From accurate records kept over a period of years, it was proved that evaporation losses during plant shutdown overnight and on weekends accounted for 100 quarts a week or 20% of the purchased supply. This meant an annual wastage of $2,500.

Now, after nearly a year of trouble-free operation with the new machine, Amperex figures its cost of liquid air at $2,700 annually, 21% of former costs, or a saving of 79%.

TWELVE-ton liquid plant is heart of California Oxygen Co.'s new installation at La Habra.

HEAVY steel for ladle crane weldments are cut by flame shape-cutter, said to be longest ever built. (See story below.)

California Oxygen opens new plant

A new liquid-oxygen installation was recently opened in La Habra, Calif., by California Oxygen Co. The facility includes a new Superior 12-ton liquid plant.

The 8-acre site also includes a separate office building and a separate store for sale of welding supplies and equipment. There is 25,000 sq ft of floor area in the new buildings.

The La Habra office also serves Whittier, Santa Ana, Pomona, Corona and Riverside.

100th anniversary for Graver Tank

Graver Tank & Mfg. Co., whose welding exploits have often been described in the pages of WELDING ENGINEER, celebrates the 100th anniversary of its founding this year. Graver, which has grown from the two-man team of the Graver brothers to its present scope with plants throughout the U. S., was the first industrial concern to move into the East Chicago, Ind., industrial district.

Willard M. Broxham, Graver vice president and centennial chairman, has announced Graver will offer prizes for the following information: the location of oldest Graver tank in use; the oldest picture of a Graver tank, the best idea for decoration of a Graver tank or tanks (either in existence or planned).

Broxham indicated the first products of Graver Tank, probably fabricated in the Pittsburgh area, were office safes. All information and photographs should be mailed to the centennial committee, Graver Tank & Mfg. Co., Inc., East Chicago, Ind., before Nov. 1, 1957.

A $100 prize is offered for finding the oldest tank in use and the oldest picture of a Graver product; a $500 and two $250 prizes for the best idea for, or actual decoration of, tank facilities, whether industrial, commercial or municipal. Prize winners will be announced at the November American Petroleum Institute convention in Chicago.

Not without honor in its home town

Chalk up another piece of evidence to refute that old saw about the prophet without honor. Hobart Bros. Co. recently was the subject of a feature article published by the Troy, Ohio, *Daily News*, which told of the firm's products and their use throughout the world. The newspaper also described the Hobart Foundation as having ". . . done much to make Troy a better city in which to live."

NCG opens plant in Mississippi

Mississippi's first commercial oxygen manufacturing plant was to have begun operation May 15. National Cylinder Gas Co. owns the facility which is in the Flowood industrial area of Jackson, adjacent the mill of the new Mississippi Steel Corp. Oxygen will be piped directly to this mill.

The plant will also serve industrial and medical users in the central part of the state. NCG will produce acetylene and nitrogen as well as oxygen at the location. The Mississippi site brings to 79 NCG's number of gas producing plants in the western hemisphere.

124-ft flame-cutter speeds crane production

A 124-foot flame shape-cutting machine believed to be the longest in the world is being used to cut parts that are welded into large ladle cranes.

Installed by National Cylinder Gas Co. in the Alliance (Ohio) plant of Morgan Engineering Co., the unit adds production-line automation to industrial art of oxyacetylene cutting of heavy steel. It mounts three shape-cutting carriages on a continuous steel tracing table 124 ft long.

But production flexibility, rather than total length of cut, is the unit's most important feature, according to NCG engineers who designed and installed it to Morgan specifications. With it, idle time spent waiting for overhead cranes to move away one piece of work and set up another to be cut is considerably reduced. The unprecedented amount of working space lets the cranes set up a job in one area while the cutting machine carriages are at work in adjacent sections of the table.

Four electrically-controlled oxyacetylene cutting torches are mounted on each of two of the cutting unit carriages and six torches on the third, providing a total of 14 torches that can be in operation at one time.

One of the big jobs for which the machine was designed in cutting parts from more than 920 tons of steel that go into each of three 500-ton-capacity ladle cranes being manufactured by Morgan for a new eastern steel plant.

A bearing block with a thickness of 26 in. is torch cut and ladle hooks weighing 17 tons each and more than 17 ft long are made by laminating 13

(Continued on page 100)

here is an additional line every welding supply distributor can handle profitably

whether or not you are now handling our line of welding and flame cutting apparatus these many air-gas torches will be of interest to you and can be handled by you at a desirable profit. Our brochure No. 8 illustrates and describes equipment which is noncompetitive but supplementary.

Is natural gas scheduled to replace a manufactured gas in your territory? If so, we have something of special interest to you and your Gas Company. If this conversion has been made in the past, we have equipment your customers will be interested in. We have designed, produced and used torches and other items for the control of flammable gases since 1910; and we have cooperated with gas manufacturers and public utility companies for many years. Please look at the column to your right for a partial listing of some of the torches our brochure illustrates and describes in a colorful and interesting manner . . . **write for it today**

here is a partial list of torches and operations listed in our Brochure #8:

ribbon flame burners for the glass blower and others . . .

crossfires for all fuel gases and either compressed air or pure oxygen . . .

small bench blowpipes for laboratories, radio technicians, electricians, orthodontists and others . . .

air-gas mixers for many purposes and in all capacities . . .

fine needle valves in all sizes . . .

a modern alcohol blowpipe for glazing, heat treating of molding compounds, smoothing wax surfaces or working with plastics . . .

cannon fires which can use many fuel gases with air or oxygen . . .

small air-gas torches for hand or bench use . . .

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LCP-10" 17 oz. HCP-9" 14 oz. Cone & X-Chisel

Models WH: 10-20-30 12" 14 oz.

Model AW Dual Tool 10½" 16 oz.

Model F1W "Re-Bit" 10" 14 oz.

J-9" 13 oz. N-10" 15 oz. Cone & Chisel

Model M Chisel & X-Chisel 10" 15 oz.

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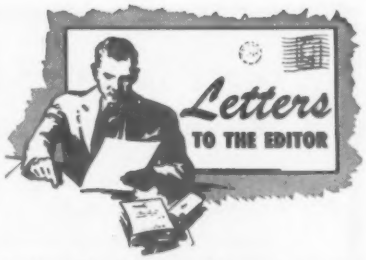

Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Acetylene and propane

Dear Sir:

We enjoyed the April issue of *Welding Engineer*. I particularly like the article on "Versatility and economy . . . the factors that favor acetylene," as I had heard this matter discussed at various times, but had never seen authentic figures on this subject.

C. H. Anderson
Aberdeen, S. Dak.

Welding curriculum

Dear Sir:

As a reader of your magazine for over 30 years, I want to offer my congratulations, very late though they be, on your assumption of the management.

The contribution which you and your magazine have made to the welding industry cannot be measured. The words "weldor," "Tig" and "Mig" will be around for many years.

This year I will have completed 41 years in the welding industry . . . I will have to confess that the more welding I see and the more I study, the less I seem to know about this business.

The thing I note is that the books do not keep up with the rapid strides being made with the new processes.

I am interested in getting a local college to include in its curriculum a course in welding engineering. In your position, could you tell me how many schools in the U. S. have such courses?

I work for a large corporation, and every type of engineer wants to tell the weldor what to do, and I regret to say that in too many cases he doesn't know what he is talking about. When are we going to educate men who know how to direct welding in industry?

Incidentally, I enjoy your editorials . . . we need voices to speak out on the subject of welding.

Leo P. Gorman
Anaheim, Calif.

30 YEARS AGO

(Taken from *The Welding Engineer* of June, 1927)

Welding was as important in early aircraft as it is now. Charles A. Lindbergh, states the editorial page, ". . . staked his life and fortune on a flawless weld and found his judgment amply confirmed." The "Spirit of St. Louis" employed all-welded construction.

—30 YEARS AGO—

Winners of the 1924 and 1925 Morehead medals were M. Edmond Fouche and Mr. Augustine Davis, respectively, for pioneer work in the acetylene industry. Medals were presented at a dinner in New York City, June 1.

—30 YEARS AGO—

A feature article relates the welding of the kitchens in the Stevens Hotel (now the Conrad Hilton) in Chicago. Steamers, warming tables, shelving, were among the many welded units.

—30 YEARS AGO—

E. P. Larkin was appointed New York district manager by R. D. Thomas & Co., Philadelphia.

—30 YEARS AGO—

O. L. Howland, formerly of the Detroit office, Central Steel & Wire Co., has joined the sales force of Lincoln Steel Co., Chicago.

—30 YEARS AGO—

R. K. Randall, formerly head of YMCA technical school, has, in partnership with E. T. Scott, organized the Cleveland Welding School, Cleveland.

—30 YEARS AGO—

The 90-mile Mokelumne pipeline in California has been a subject of discussion due to weld failures. Professor L. T. Jones, University of California, told the New York Section of American Welding Society that by welding at night, using low-carbon vanadium rod, normalizing the weld metal and laying pipe in groups of 20, there would be no failures.

—30 YEARS AGO—

Welding has been adopted to replace riveting in piping and other parts in a number of hydro-electric plants now under construction in Europe.

BERNARD

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WITH RENEWABLE HEADS...*an Unbeatable* LOW COST FEATURE!

PROVIDES NEW HOLDER EFFICIENCY FOR ½ NEW HOLDER PRICE. All working parts of the "Short-Stub" which wear out are contained in the head portion, the handle portion lasts quite indefinitely. To obtain new holder efficiency at a cost as low as *$3.20 each, it is only necessary to install a new Renewable Head to the original handle portion.

Heads come packaged and completely assembled ready for immediate attachment without tools in just 3 seconds.

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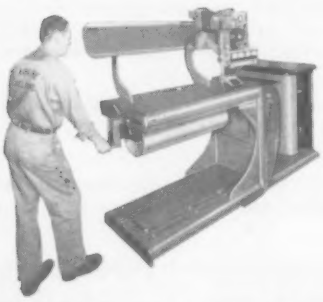
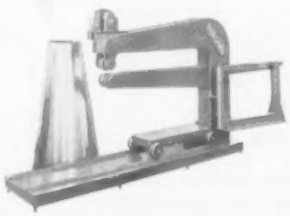


LONGITUDINAL WELDER—This automated unit welds at speeds up to 300″ per minute. Metal positioning and holding segments operate pneumatically. Made in 2- to 12-ft. lengths, welds .010″ to 1″ in thickness.



PLANISHING ROLL—This fixture cold-works metal under pneumatic-hydraulic pressure, planes down seams to aerodynamic smoothness. Diameters 1¾″ to 10 ft., and to 10 ft. lengths on large diameters.

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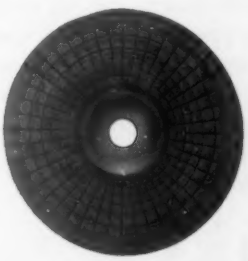

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for low cost inert gas arc welding of mild steel

The Aircomatic arc welding process using carbon dioxide gas as the shielding medium, means high economy and speed in certain mild steel welding applications.

Fabricators of mild steel products such as car frames, fuel tanks, water heaters, trailer frame supports and pedal levers report outstanding results and substantial savings through this new technical development.

This combination of Aircomatic equipment (manual or automatic) and CO_2 is particularly recommended for high production work where the faster welding speeds and the inexpensive shielding gas will most benefit the cost conscious user. It is an ideal process for single pass applications and multiple pass applications. Joining sections of large diameter steel pipe is but one example.

If you weld mild steel, investigate the possibilities and advantages of using the Aircomatic process in your particular operation. Complete information and literature is available. Write Airco today!

AT THE FRONTIERS OF welding PROGRESS YOU'LL FIND . . .

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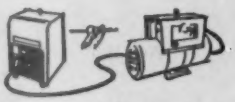
Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide — gaseous, liquid, solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetate, alcohols, and other synthetic resins.

JUNE
1957

Your *Weld World* at press time

Last minute news of interest to those engaged in joining and severing materials.



. . Miller Electric Mfg. Co. unveils "Gold Star SR" welder any day now. New unit won't look different except for added depth of 4 in., but Miller says it will contain entirely new transformer, new stabilized welding current and new completely-sealed semimetallic rectifier.

. . Westward expansion is next major move for prominent manufacturer of arc-welding accessories.

. . 1957 is expected to be Taylor-Winfield Corp.'s best year in history—surpassing even record sales of 1956. T-W thus confirms, on an individual basis, what WE has predicted for industry this year.

. . Despite present below-capacity production, industry leaders are predicting need for greater steel-making facilities. Roger M. Blough of U. S. Steel says his firm must increase capacity about 1 million tons annually for next 18 years to keep pace.

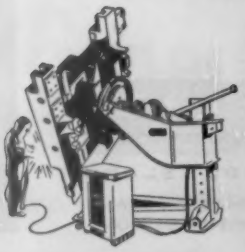
. . New entry in Tig torch field is K-G Equipment Co. It's K-G's first venture into inert-gas equipment.

. . First quarter sales report from NWSA members shows business is up 12% from same period last year. Biggest jump is in the Southeastern Zone—up 21%.

. . If present plans are carried out, more independent oxygen and acetylene plants will start operations this year than ever before. At least 24 are in the planning stage or have begun production.

. . Aluminum, already making rapid gains, will find even more applications on 1958 automobile models. (See the article in this issue on Ford Motor Co.'s construction of an all-aluminum, all-spot welded Army truck.)

. . It won't be long before you can X-ray your welds in color. A Philco development, color X-ray will enable better, speedier interpretation of your pictures.

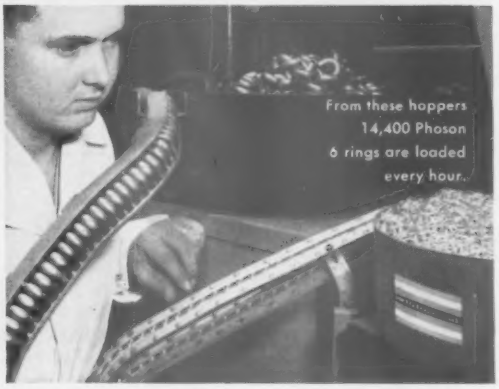


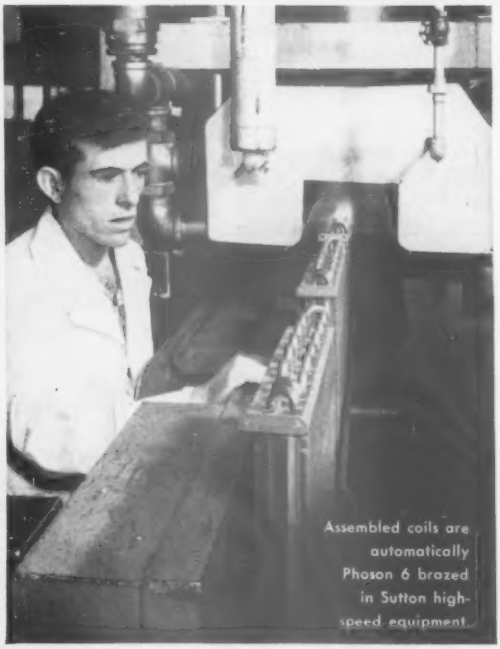
. . Even a second major appeal by the President will probably fail to halt a widespread congressional decision to cut the 1957-58 budget. Amount of the cuts likely to be made, however, is a moot point. Experts feel that spending increases made or planned by Congress could prevent a sizeable budget reduction.

. . Steel price increases seem assured when the steel industry makes a second payment on its three-year labor contract July 1. Hourly wages will be hiked seven cents; Sunday premiums will rise to 20% of base pay. Forecasters predict a price raise of up to $6 a ton—making the composite price of finished steel $146 a ton.

UNITED PHOSON 6 MAKES AUTOMATION IN BRAZING PRACTICAL... HIGHLY PROFITABLE

Brazing, too, can be fully automated. With the equipment shown, brilliantly engineered by The O. A. Sutton Corporation, up to 14,400 brazing rings are loaded every hour. Thanks to the high quality and precision tolerances of Phoson 6 rings, this company, one of the world's leading manufacturers of comfort cooling appliances, has increased assembly speed of copper return bends by 12 times!





To permit this amazing speed, brazing rings must fit tightly — perfectly — completely eliminating slippage prior to brazing. Here's how United Phoson 6 rings meet all the strict precision requirements of automation:

FIRST . . . Rings of Phoson 6 are preformed to exacting and uniform tolerance of +.000" to −.005" ID with a maximum helix of .015".

SECOND . . . at the lowest practical temperature, Phoson 6 brazes leakproof joints of highest strength, ductility, corrosion resistance and thermal conductivity.

These two points add up to one fact. You can profit now from automated brazing! Without delay, get the whole story. Write direct to United or see your nearby United Welding Supply Distributor.

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COPPER, BRASS AND ALUMINUM WIRE AND TUBE . . . BRAZING ALLOYS, PHOSON, SIL-BOND

Aluminum Welding Cable

Makes Your Job Easier!

Saves Effort!

Lighter weight and superior flexibility lets you weld faster and easier on every job . . . less operator fatigue!

Type D-866 *Aluminum* Welding Cable is available in all standard sizes from General Cable.

General Cable . . . *at your service!*

GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, N.Y. Offices and Distribution Centers Coast-to-Coast

They're REINFORCED... they have longer life, they do more jobs!

FOR LIGHT WELD GRINDING. The BFR wheel is a soft-action, semi-flexible hub-type, containing cotton fabric and an additional Nylon layer. It's ideal for blending contours and corners . . . removing rust and scale . . . scarfing and beveling before welding . . . reaching hard-to-get-at places.

FOR HEAVY WELD GRINDING. The BD hub-type wheel, reinforced with glass cloth plus Nylon, is rigid. Made in three grades of hardness for best performance on your tougher jobs, such as smoothing flame-cut edges and stainless steel welds . . . slotting, notching and cutting-off operations . . . removing light fins from castings.

Norton BFR and BD wheels bring the "Touch of Gold" to your light and heavy grinding

W-1794

These two Norton developments — BFR and BD reinforced hub-type wheels — cover an almost endless list of weld shop grinding operations. And their extra versatility, economy and resistance to breakage add the profit-building "Touch of Gold" every time they go to work for you.

Learn more about what these fast, strong, money-saving wheels can do for you. The folder "*From Roughing To Finishing*" contains complete information on the semi-flexible BFR and the rigid BD — including operations, wheel sizes, operating speeds, recommendations and prices. Ask your Norton Distributor for it or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

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ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION:
Coated Abrasives • Sharpening Stones • Behr-cat Tapes

Think you'll ever need
A-power fittings like these?

TUBE-TURN* Stainless Steel Elbows—heavy wall thickness for nuclear energy reactor.

Name your piping problem...
TUBE TURNS CAN HELP YOU!

No matter what kind of welded piping system you build . . . here's how Tube Turns can be of help:

Tube Turns' line includes 12,000 *standard* welding fittings and flanges, plus thousands of *specials* such as the A-power fittings shown above. When you buy from this *complete-line* leader, you get what you need *promptly* . . . products of unsurpassed *quality* . . . backed by experienced *engineering service* . . . for reliable, *low-cost piping.* Order from your nearby Tube Turns' Distributor.

*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

The Leading Manufacturer of Welding Fittings and Flanges

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A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland
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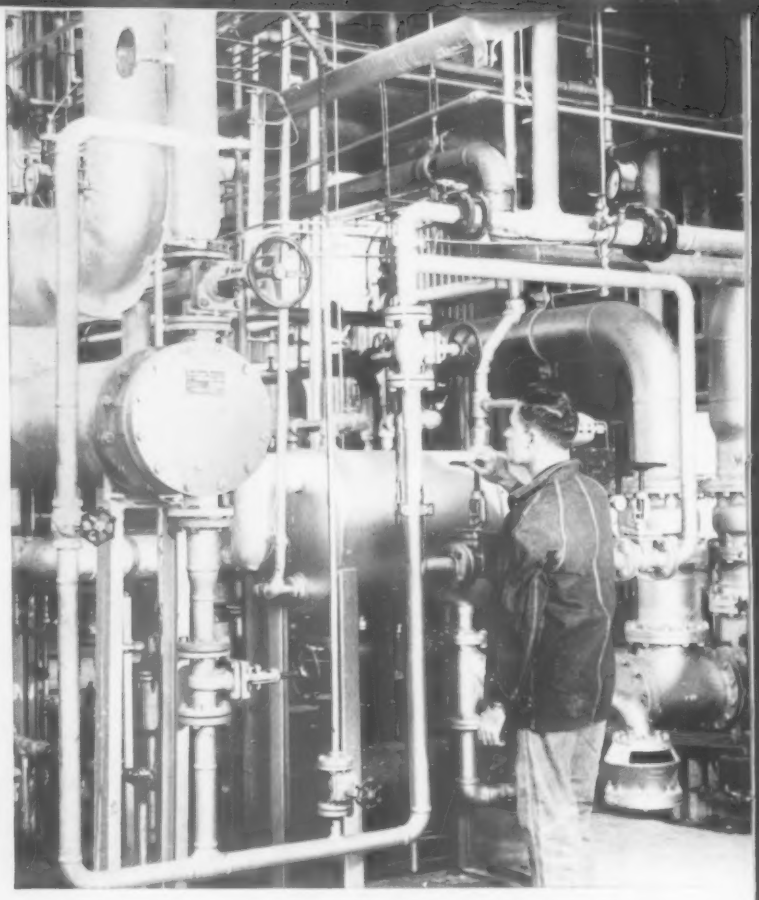
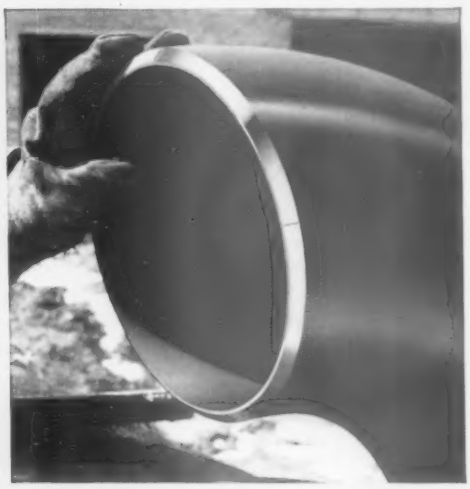
HOW YOU SAVE

12,000 "TUBE-TURN" PRODUCTS

to help you save 3 ways...



SIMPLIFIES ENGINEERING. There's no compromise when you specify TUBE-TURN products. You can count on getting the exact fittings for your project ...the right type, size, schedule and material for every piping service. Shown at right: Aluminum piping with TUBE-TURN Welding Fittings and Flanges, in water purification plant of The General Tire & Rubber Company, Chemical Division, Ashtabula, Ohio.



SPEEDS UP THE JOB. Uniform size, circularity, wall thickness of TUBE-TURN Welding Fittings assure good fit-up and alignment . . . help make piping installation work faster. Each fitting is marked with *complete* specifications for quick, accurate identification. Quartermarked bevels simplify fabrication.

ONE-ORDER PURCHASING. Your nearby Tube Turns' Distributor provides this complete-line service promptly. Hence, you can make *one order* fill all your needs in welding fittings and flanges . . . to cut red tape and save purchasing time.

HELPFUL DATA. New Tube Turns' booklet gives information on pipe, fitting and flange materials. Mail coupon for your free copy.

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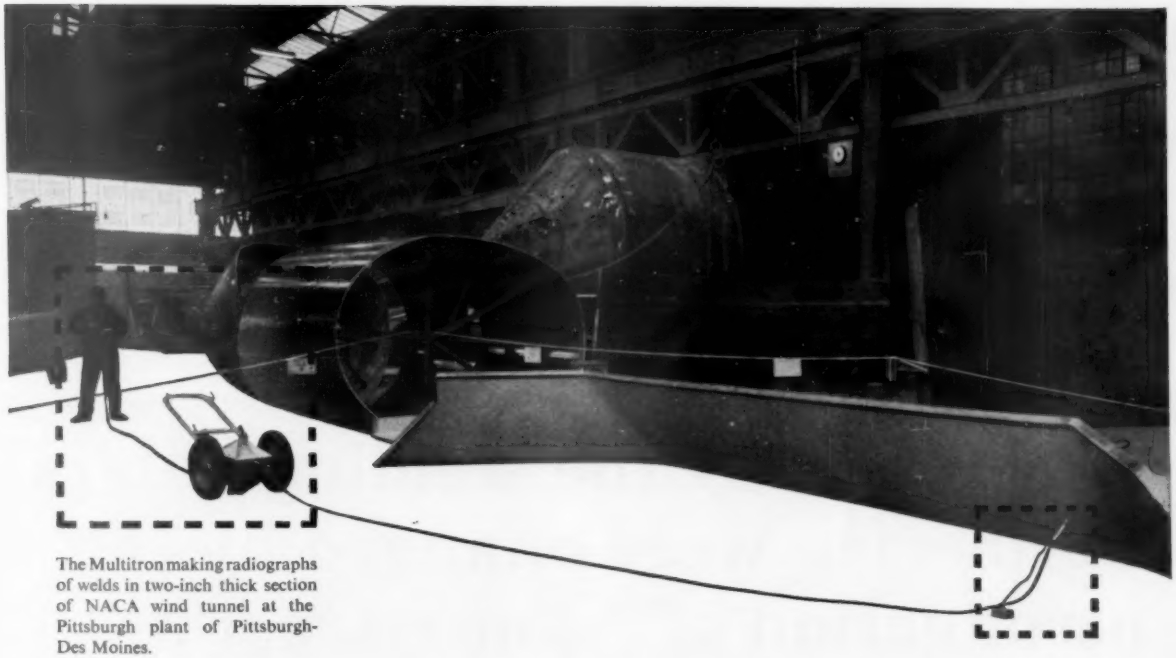


The Multitron making radiographs of welds in two-inch thick section of NACA wind tunnel at the Pittsburgh plant of Pittsburgh-Des Moines.

RADIOGRAPHY MACHINES that do more jobs for less money

Pittsburgh-Des Moines Steel Company manufactures parts for wind tunnels housing blasts at Mach 3, Mach 4 . . . yes, even Mach 5.

To certify the integrity of the parts they build, Pittsburgh-Des Moines subjects them to a weld-by-weld radiography inspection with the Multitron, a gamma ray machine housing radioisotopes, built by Nuclear Systems, a division of The Budd Company.

The Multitron replaces X-ray equipment that would have cost five times as much, and saves one-third what the work would have cost if done by X-ray. In addition, its mobility—there are no electrical or coolant connections—provides further savings by permitting the machine to be taken to the work, rather than the work to the machine.

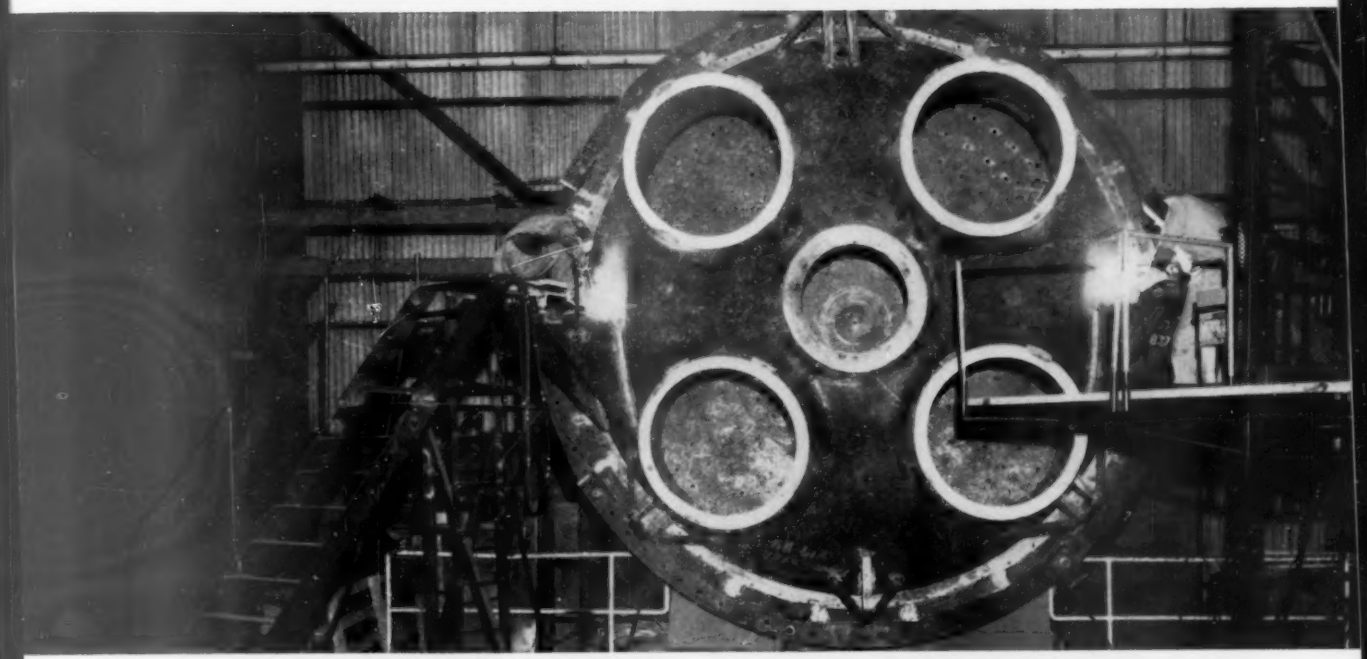
Nuclear Systems' complete line of radiography units places radiography within the price range of small shops and foundries, and has made what used to be an expensive and cumbersome operation economical and flexible.

NUCLEAR SYSTEMS
A DIVISION OF THE BUDD COMPANY, Philadelphia 32

In October '54, the welding habits of America were changed by the introduction of Atom • Arc, the first all position iron powder low hydrogen electrodes.
Now, equally important changes are taking place with the NEW . . .

ATOM·ARC DH-12

IRON POWDER LOW HYDROGEN ELECTRODES FOR DOWN HAND WELDING



NEW ATOM•ARC DH Electrodes deposit up to 12 pounds of weld metal per hour with X-ray quality and physical properties equal to class E-7016 electrodes.

Just imagine, the visibility and flexibility of metallic arc welding with welding speeds and deposition rates comparable to semi-automatic submerged arc welding . . . and without messy fluxes or cumbersome equipment to handle. These advantages are yours with these *new* electrodes.

ATOM · ARC DH-9 FOR DOWN HAND WELDING AND HORIZONTAL FILLETS deposits X-ray quality weld metal at the rate of 9 pounds per hour at 300 amps. Burn off rate is 12.4 inches per minute.

ATOM · ARC DH-12 FOR DOWN HAND WELDING deposits X-ray quality weld metal at the rate of 12 pounds per hour at 360 amps. Burn off rate is 11.9 inches per minute.

• • • • • **Mail coupon today for complete facts ►**

Please send me the facts on Atom · Arc DH Electrodes.

DH-2

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Alloy Rods Co.

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NO FINER ELECTRODES MADE . . . ANYWHERE

Man, this ZIP-14 electrode's the greatest!

He's right. The new Westinghouse ZIP-14 universal electrode handles easily in all positions, has very low spatter loss, deep penetration, fast burnoff, feather-touch slag removal and a quiet, smooth arc. This powdered-iron electrode fits both E-6014 and E-7014 classifications. There's no burning through, no undercutting even on vertical down work.

What more can you ask in an electrode?

We know you'll like it. Try it in your own shop—under your conditions! It will sell itself!

J-21984-A

Only Westinghouse offers this welding leadership!

YOU CAN BE SURE...IF IT'S Westinghouse

BETWEEN PASSES

Tig issue

The many pages on Tig welding in this issue are the direct result of numerous requests we've had for information on this process. *Welding Engineer* plans to make available reprints of all this material, with the possible exception of application articles. If you want copies, write us. Single copies will be sent without charge; prices will be quoted for quantity orders.

WE's next special issue you won't want to miss: non-destructive testing in August.

welding catalogs

All welding reports available from the federal government are listed in eight new Catalogs of Technical Reports. The catalogs identify about 1,000 such reports on welding research and development, including a large number of German technical papers captured by the Allies during World War II. Catalogs can be obtained, at 10 cents per copy, from Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D. C. The reports themselves are available in printed form from OTS or in photocopy or microfilm from the Library of Congress.

the market

Speaking at a recent welding conference held at Fort Belvoir, Va., J. H. Humberstone, president of Air Reduction Sales Co., predicted that welding industry sales will go over the billion-dollar mark before 1960. *WE* predicted last month that it would hit that coveted mark this year. We're not taking any side bets, because we admire Joe Humberstone's progressive attitude, but we think this is one time he is too conservative . . . we hope so, anyway.

move over, Ike

Editorial members of our staff belong to the Chicago section of AWS. But for the past several years, we have been unable to participate in one of the more enjoyable events on the local section's calendar—the annual golf tournament. Too many

conflicting engagements. Not this year, though. Come Saturday, June 8, you will find us on the Nordic Hills course in Itasca. We still hope to break 100. Incidentally, June 8 to 15 is "Let's Play Golf Week." Good timing, what?

safety at shows

We see that the International Acetylene Association's oxyacetylene committee has established a set of recommendations for safe usage of compressed gases in welding, cutting and heating operations at public exhibitions and trade shows. The project was initiated by an inquiry to the IAA for an official statement regarding maximum pressure, gas content, and number of cylinders that should be allowed in an exposition building. The recommendations are expected to be furnished as an industry standard to exhibitors and to fire-prevention officials and other organizations responsible for safety in public places.

beauty of steel

"Structural steel in today's architecture" is the title of a photographic exhibit for art museums sponsored jointly by the American Institute of Steel Construction and the American Federation of Arts. Examples of welded buildings are included in the exhibit—among them the Coliseum in Charlotte, N. C., which *WE* described in November, 1955, and September, 1956. *WE*'s editorial stand on steel construction was echoed recently by N. P. Hayes, president of AISC, when he said that potential economies and esthetic possibilities of structural steel as a construction material have been scarcely touched. He forgot to mention only one thing—it has to be *welded*.

new rectifier?

Silicon carbide is best known to our industry as an abrasive. But General Electric reports its research laboratory has operated a rectifier made from this material at temperatures up to 1,200 F and as low as —100 F. Rectifiers presently used in welding machines are made from single-element materials—selenium and silicon. G-E emphasized that the silicon carbide rectifier is still in the laboratory development stage.

billions for research

Industrial research has become a $6,000,000,000 activity, employing more than half a million people. It is now one of the nation's largest businesses, amounting to 1½% of our gross national product. E. Duer Reeves, of Esso Research and Engineering Co., told a recent National Industrial Research conference that research is now an integral part of a firm's operations and an important factor in competitive strength.

man vs. machine

Automation, hah! When Dravo Corp. had to make welded repairs inside an 18-in. pipe at the Shippingport, Pa., commercial atomic power plant, who did officials call upon? Not some inaminate machine, but E. S. David, of Augusta, Ga., a 4-ft weldor.

parting shot

We know that most of you wait with bated breath to read this part of *Between Passes*, so here goes: June 4 will be Old Maids' Day! These "days," "weeks," etc., are getting so specialized, we are thinking of petitioning for a day for married editors of welding magazines who wear glasses and a size 38 (regular) suit and own homes (mortgaged) in Chicago suburbs.

IMPROVED MAGNETIC STARTER has quick response bi-metallic thermal overload relays which sense current changes and to help prevent motor burnout in case of sustained overloads or accidental single phasing. Large starter contacts are long-lasting, won't chatter.

ANNOUNCING A NEW LOOK IN M-G WELDERS!

New General Electric M-G Set Speeds Welding with Stable, Penetrating Arc—In Any Position

General Electric's new motor-generator welder gives you the stable, penetrating arc you need to get even those tough, out-of-position welding jobs done faster and better.

The secret? General Electric's NEW laminated frame welding generator, working in combination with a unique transformer reactor.

The arc is stable because this new reactor provides excellent control of current surges and assures immediate high recovery voltage at all settings. No need to worry about costly delays caused by electrode freezing or popouts.

A high level of "arc force," with the stable arc, makes the General Electric m-g set ideal for a wide variety of industrial applications, including light, medium, and heavy d-c metal-arc and inert-arc welding.

And here are just a few other reasons why the new G-E motor-generator welder answers your need for high-quality welds in less time and at less cost.

EASY TO USE—current is not sensitive to changes in line voltage—once the simple current setting has been made, no further adjustment is necessary. Arc has quick response and good control in all positions.

FUNCTIONAL DESIGN—two welding sets can be installed in the space normally required by one, saving valuable floor area—brushes can be changed while welders are stacked—cooling air enters the ends, exhausts front and back, to prevent recirculation.

LESS MAINTENANCE—constant pressure brush springs give maximum brush life—rubber-mounted, extra-width, pre-lubricated bearings require no maintenance—motor windings are Mylar* insulated and Dri-Film† coated to help prevent insulation failures—heavy-duty motor starter contacts last for years.

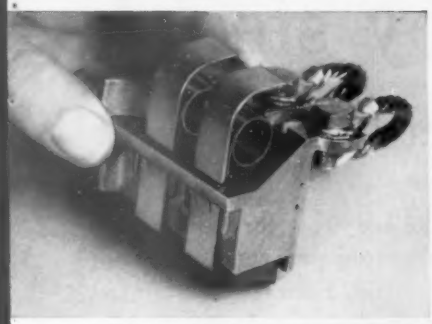
General Electric's new d-c motor-generator sets are available in both 300 and 400 ampere designs, rated 40 volts, 60% duty cycle. For more information about them, contact your nearby General Electric Welding outlet, listed in the yellow pages of your telephone book. Write for descriptive bulletin GEA-6423 to Section 711-8 General Electric Company, Schenectady 5, New York.

*Reg. Trademark of DuPont Co.

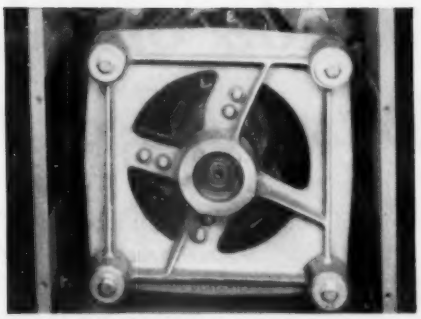
†Reg. Trademark of General Electric Co.

Progress Is Our Most Important Product

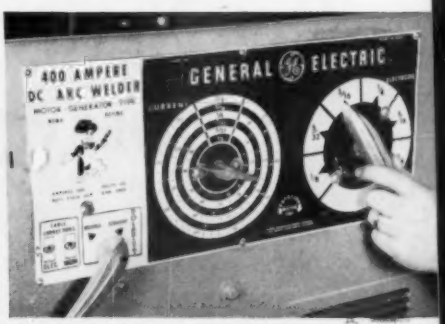
GENERAL ELECTRIC



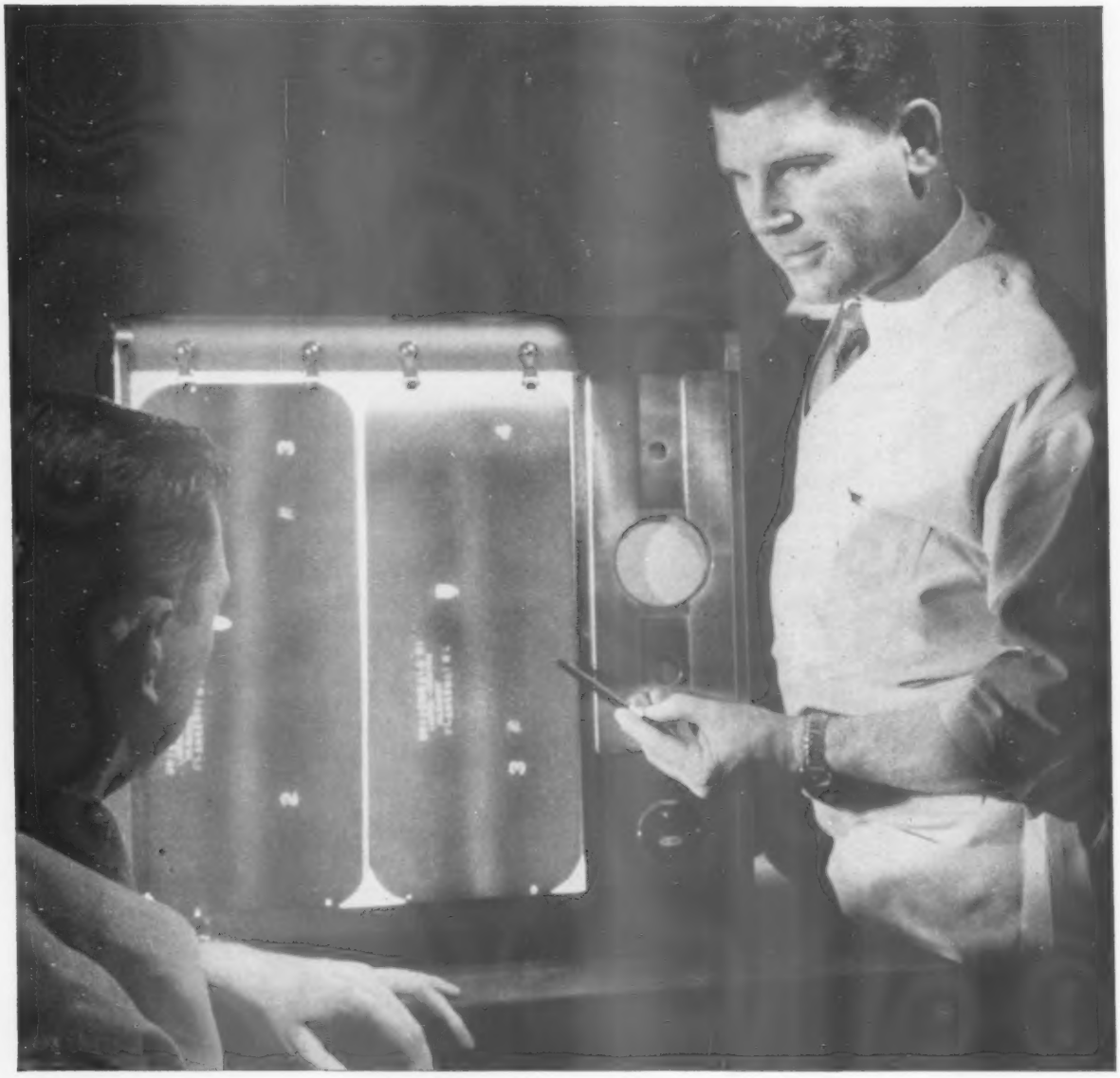
CONSTANT-FORCE brush springs need no adjustment; give the correct constant pressure during brush life. Removable spring clips permit easy replacement of brushes.



STURDY CONSTRUCTION results from one inch diameter steel rods which link the bearing housings with welded generator and motor frames. Sturdy ¼" angles are welded to the generator frame to provide a solid base.



DUAL CONTROL DIAL is fully calibrated, easy to read. Just select electrode size on Electrode Selector, then set sensitive long-scale current control for desired welding current.



Get X-ray welds on alloy steels!

with P&H Low-Hydrogen electrodes

Here are electrodes that can keep you out of trouble on alloy steels.

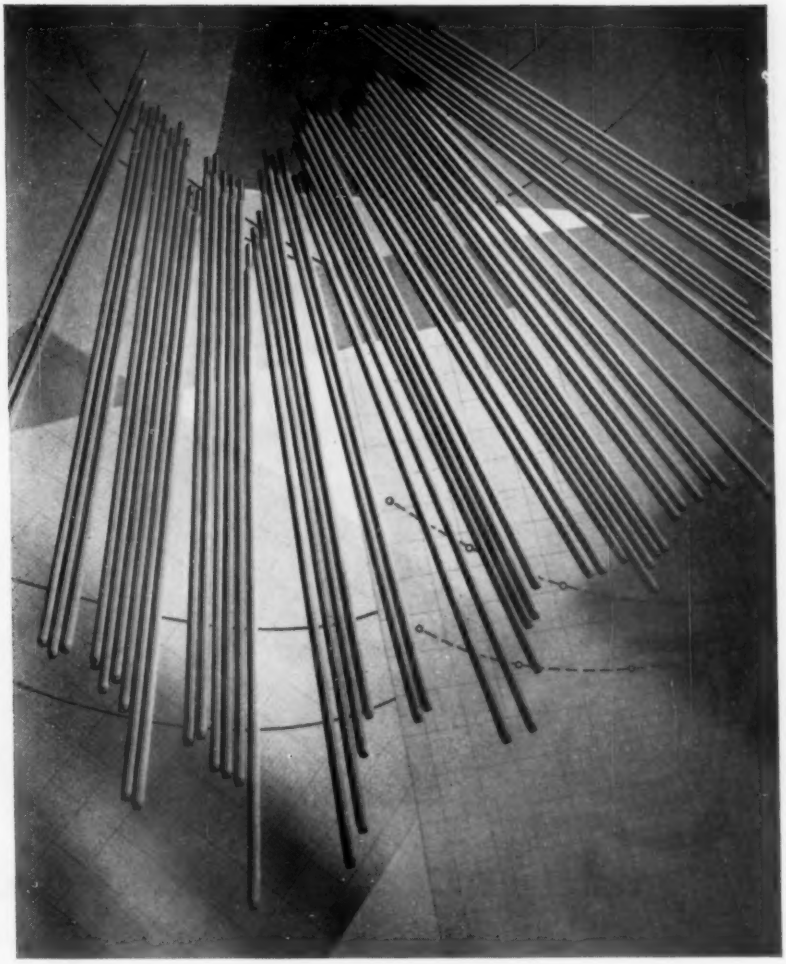
P&H low-hydrogen electrodes give superior x-ray welds, with no porosity or cracking. Welds have exceptional strength and ductility through a wide temperature range, with as-welded properties comparable to stress-relieved.

Check P&H low-hydrogen rods for your really tough jobs — you'll find one to match the chemical or mechanical properties of any problem alloy you're handling. Write Dept. 316B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

HARNISCHFEGER

P&H WELDERS • ELECTRODES • POSITIONERS

MILWAUKEE 46, WISCONSIN



NAME THE PROPERTIES you want in welding rod coatings

...and Foote *will supply the raw materials!*

Welding Rod Coating Formulations can get rather complicated! But if you're using FOOTE RAW MATERIALS in your formulations, you have a head start on getting just the right combination of properties you require.

In the application of coating formulations to welding rods, Foote raw materials give coatings smooth-flowing extrudability, rugged green strength, and crack-free drying characteristics.

In the performance of coating formulations in actual welding, these materials produce high alloy efficiency, steady arc action, good slag characteristics, proper deoxidation, and efficient metal deposition.

For these coating properties and more, specify Foote Alloying Materials, Arc Stabilizers, Fluxes, and Slag Forming Materials. Write for our informative brochure, entitled "Raw Materials For Welding Rod Coatings". Address request to Technical Literature Department, Foote Mineral Company, 453 Eighteen West Chelten Building, Philadelphia 44, Pa.

Foote MINERAL COMPANY

Pioneer in the manufacture of welding rod coating materials

RESEARCH LABORATORIES: Berwyn, Pennsylvania

PLANTS: Cold River, N.H.; Exton, Pa.; Kings Mountain, N.C.; Knoxville, Tenn.; Sunbright, Va.

WELDING GRADE FERRO ALLOYS • LITHIUM METAL, CHEMICALS, MINERALS • STRONTIUM CHEMICALS • ELECTROLYTIC MANGANESE METAL • STEEL ADDITIVES • COMMERCIAL MINERALS AND ORES • ZIRCONIUM, TITANIUM, HAFNIUM (IODIDE PROCESS)

Make ALLOY weld deposits with mild steel electrodes

WITH Lincoln agglomerated fluxes, you can weld *any* alloy. These agglomerated fluxes can be bought in small quantities at standard price for testing and to reduce your inventory costs. Every flux is custom made to buyer's specific requirements . . . delivery within two weeks.

Agglomerated alloy fluxes using mild steel wire give you the lowest cost alloy welding for large or small runs.

WELDING ENGINEERS

Write for Weldirectory SB-1354 giving specification on Lincoln Agglomerated Fluxes. Write

THE LINCOLN ELECTRIC COMPANY

Dept. 1729, Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

When Lincoln agglomerated fluxes

Handle any alloy need

Yet sell for low price

WHY use anything but Lincoln for submerged arc welding

JUNE, 1957

Welding Engineer

ESTABLISHED 1916

Welding's "current textbook"

MILLIONS of people keep up with the news by reading their daily newspapers . . . more millions keep abreast of industrial progress through business publications. Readership surveys on the reading habits of WELDING ENGINEER subscribers and their friends, for example, indicate that nearly 100,000 persons read WELDING ENGINEER each month.

Such a vast reader audience places a tremendous responsibility on an editorial staff. There is the continuing problem of ferreting out the latest and best on what is happening, for a good business paper must be the "current textbook" of the industry it serves. For nearly 60 years, WELDING ENGINEER and its predecessor, *The Acetylene Journal,* has been the textbook for the welding industry.

The reader's problem of keeping pace with advancements in the field of joining and severing of materials can be solved only by continual reading. Yet there are those who tell us they "don't have time to read." WELDING ENGINEER answers this complaint by concise reporting and editing. Articles may be longer, but never more complete, than those published in WELDING ENGINEER. For the busy reader, we present essential facts—facts to make everyone's job easier.

As in every area of industry, newcomers enter the welding field each day. This means that a "current textbook" must deal, not only with late news, but also with basic welding information so that newcomers may catch-up with their coworkers.

ACTUALLY, some older readers have also been receptive to the review articles published recently—indicating that learning is a process that never stops and pointing up the value of continuing industry education.

In some cases, textbooks provide needed welding information, and a magazine such as WELDING ENGINEER simply highlights essential points, or those factors subject to constant change. In other instances, a business publication may be the sole source of data. For example, this issue of WELDING ENGINEER presents a comprehensive feature on Tig (tungsten inert-gas) welding.

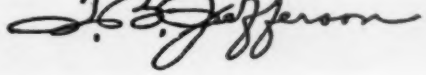
For the first time, there is compiled in one place the essential facts about the most important welding advance of the past decade. The entire story is presented concisely, beginning with the inception of the Tig process and carrying through with modern developments . . . factors influencing joint design . . . the need for backup . . . and with application articles that illustrate some uses of this versatile process.

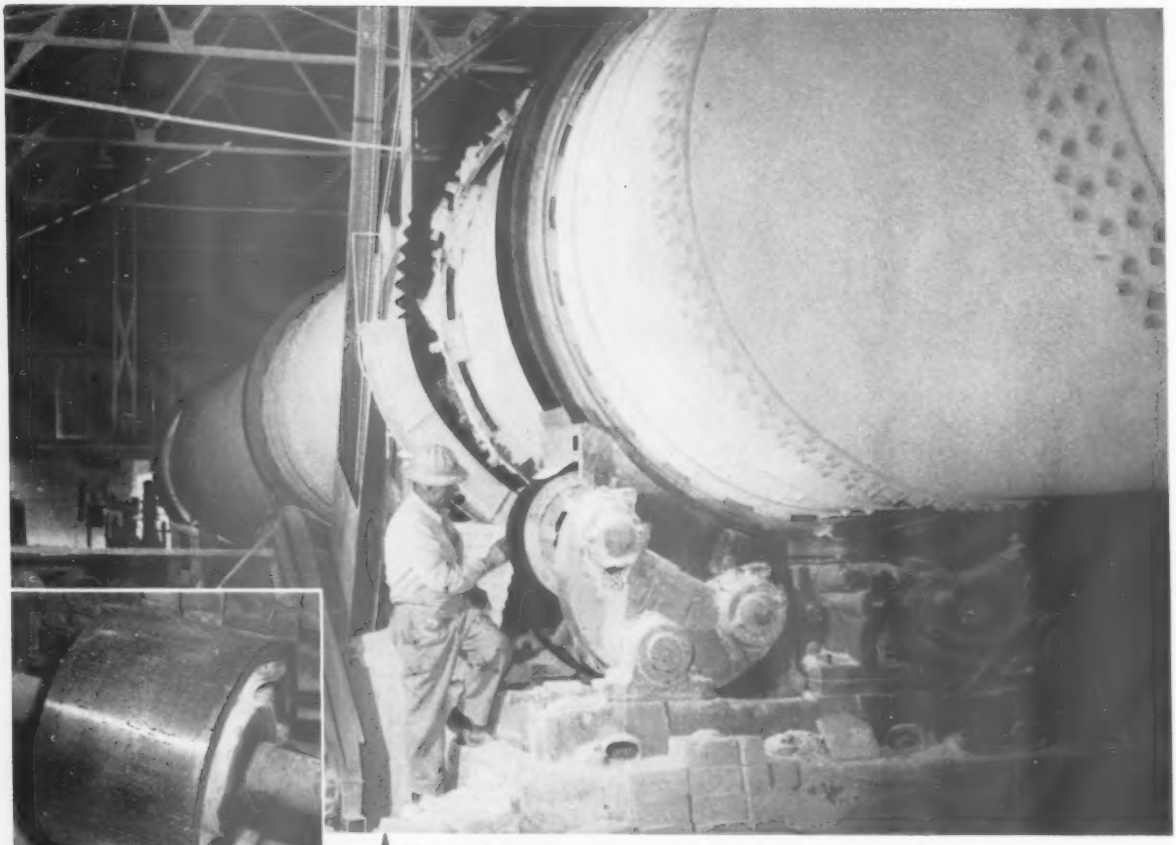
FROM time to time, WELDING ENGINEER will present other comprehensive features dealing with subjects on which textbook information is lacking or incomplete. The next article of this nature, on the subject of nondestructive weld testing, will appear in the August issue. If you, our readers, have subjects in mind which you would like to see covered more completely, let us know. Our aim is to serve you in a manner that will enable you to stay informed on the most important and useful happenings in the industry that helps you earn your livelihood.

If, in our current textbook program, we are able to make more people conscious of the many welding processes currently available—and of their untold application possibilities—we will be doing the kind of educational job for which we are striving.

WELDING ENGINEER has never taken a back seat when it comes to promoting welding—and will never do so—but to accomplish the end we all desire, cooperative effort of all those interested in welding is demanded. *That goal is vastly increased welding usage!*

We can reach this goal—and, incidentally, make 1957 our industry's first $1 billion year—if all of us *talk* welding, *use* welding, *and keep abreast of welding developments* by reading the industry's "current textbook" regularly.





View showing relative size and position of furnace, rolls and rings.

Roll hardfaced with Victoralloy No. 1. After ten months of constant operation, no wear, flaking, or cracking of edges.

A case of wear and tear... and how Victoralloy solved it

PROBLEM:

The 300-ton furnace of Diamond Springs Lime Company, Diamond Springs, Calif., rolls on 16 centered 30/40 carbon steel rolls. The furnace's heavy weight and terrific heat caused the rolls to flake and crack at the edges. This in turn caused the furnace roller-rings to begin disintegrating. How to stop the wear and tear before an expensive shutdown and complete replacement of rolls and roller-rings became necessary?

SOLUTION:

Herbert Green, superintendent, and John Desson, general foreman, hardfaced the rolls with Victoralloy No. 1 Coated-Electric. Checking after ten months of operation, they found the case solved: no flaking of rolls, no cracking at the edges, and no disintegration of furnace roller-rings.

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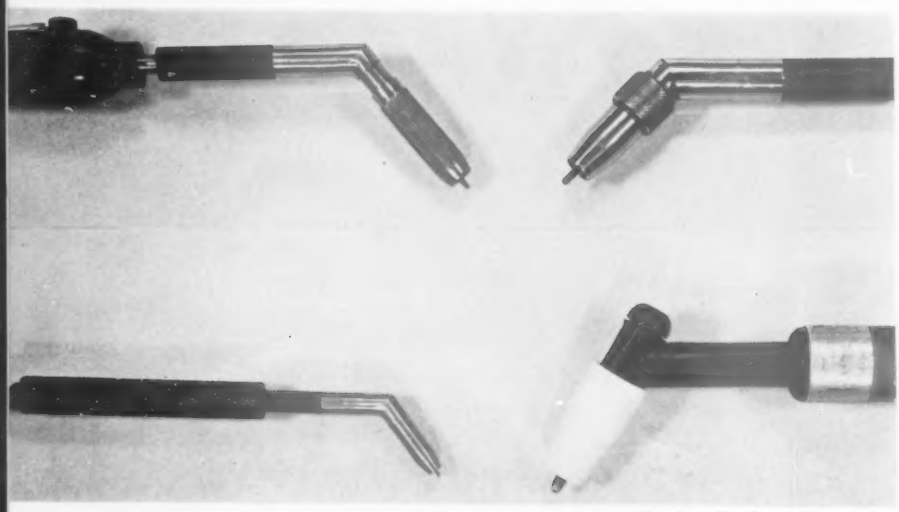
Welding Engineer

Tungsten Inert Gas

. . . the welding process with
future possibilities broad enough to amaze
even its most ardent exponents.
Over a year ago, WELDING ENGINEER began to receive
numerous requests for a special,
informative issue on the Tig process.
Here it is.
Fourteen pages are devoted in this issue to the
history, theory and application of
the Tig process.
The Editors hope this data will be as valuable
to a majority of our readers
as the Tig process itself is to industry.

Pride of the welding industry . . .

Tig—for the metals that "couldn't be welded"



PROGRESSION of Tig torch development, in part, can be seen in this photo. Two torches at left were developed by Northrop Aircraft, Inc., and are air-cooled types with metal nozzles. Torch at upper right is also air-cooled but was produced by Linde Co., as was model at lower right which has ceramic cup for shielding gas dispersion and is cooled by water.

—Courtesy Northrop Aircraft, Inc.

By Jack Fairlie

IN 1939, with the advent of a European war that threatened to engulf the world, the United States reviewed its war materials and found them lacking both in quantity and quality.

Aircraft stood in particular need of a new metal-joining process that would permit broader use of magnesium . . . so desirable because of its strength and light weight. The utilization of magnesium seemed essential to the successful development of a modern armament program, yet it remained as one of the most difficult of all metals to weld.

Researchers and engineers were well aware that abundant magnesium would permit the fabrication of simpler, lighter airframes with greater strength than could be obtained in duralumin construction.

Lab Development

At Northrop Aircraft, Inc., and in the laboratories of Dow Chemical Co., research work began that was to continue unceasingly for two years. The pace of this labor was rapidly increased on Dec. 7, 1941, when the U. S. reeled under Japanese bombardment of naval installations at Pearl Harbor and entered World War II with a vengeance.

Leading the experimental group at Northrop were Russell Meredith and V. H. Pavlecka. These men and their associates sought the development of an arc process to supplant the slow gas welding of magnesium and permit high-speed production.

Magnesium, in its molten state, is extremely sensitive to effects of the atmosphere. Measurable quantities of oxygen, nitrogen, hydrogen or any atmospheric component touching a magnesium weld pool will immediately cause oxidation and severe embrittlement.

The arc welding process that Northrop researchers sought had thus to be shielded from the atmosphere *at the arc* when in use on critical metals. There were several ways in which such shielding could be accomplished, but only one was practical under production conditions: the use of an *inert* gas fed through the welding torch to the weld area.

New Torch Design

The inert gas chosen by experimenters for use with a new type of arc welding torch was helium—and its successful use put researchers well on their way to finalizing work on a process that ultimately joined not only magnesium airframes, but other difficult-to-weld metals as well: stainless, copper, titanium, etc.

The welding process introduced to U. S. industry in 1942 was called "Heliarc"—now a registered trade name of Linde Co. WELDING ENGINEER, for the past several years, has referred to this process (and others like it) by the generic term, *Tig* (tungsten inert-gas) welding.

The industrial and military audiences that witnessed

initial demonstrations of the new process saw a lightweight, water-cooled torch with a nozzle from which helium flowed unseen. Powered by a conventional arc welding machine with a 150-amp d-c generator, the shielded tungsten electrode made dense, fine-grain welds on magnesium butt and fillet joints at surprisingly high speeds.

Then, as now, the Tig process is used with or without the addition of filler metal in rod form. When adding filler, the weldor had to hold the rod at a 90-deg angle (or more) from the electrode to avoid overheating from the electrode. This rule must still be observed.

The Tig units which went into production in 1942 were essentially the same as those produced today. Refinements in manual torch design, the development of units which worked equally well on alternating or direct current, and the evolution of automatic equipment, however, have given the process an increasing value in the intervening 15 years.

In Sharp Contrast

Photographs accompanying this article illustrate the design of a modern, manual Tig torch. Slim and easy to handle, it presents a sharp contrast to the bulk of an electrode holder and the weight of a gas torch.

Basic components of the torch are:

(1) the *handle*, through which passes a power cable, gas flow line, and water feed and return lines if the torch is a water-cooled type;

(2) a *collet adjusting cap*, which varies in size with the electrode length it contains;

(3) *tip collets*, which also differ in size to accommodate varying electrode diameters;

(4) a *nozzle*, which may be made of ceramic, silicon carbide, porcelain or metal, and through which flows the shielding gas, and

(5) a *tungsten electrode*, in diameters from 0.020 to ¼ in., and in lengths from 2 to 18 in.

Increased Argon Use

The shielding gas initially used with the Tig process —helium—is still a popular choice. But more plentiful and equally inert argon finds a broad market throughout the U. S. *(a $29 million one in 1956).*

Argon is often combined with helium, wherever operating factors permit such a mixture, and argon may also be used in conjunction with carbon dioxide. This latter "mixture" is achieved in a concentric nozzle arrangement on the torch that floods molten metal with argon, and the area immediately outside the puddle with CO_2. Such a set-up results in marked economy through decreased need for the more expensive argon.

A *packaged* gas mixture recently introduced for Tig welding is one of argon and hydrogen. Sold for less than the cost of helium, it reportedly gives many of helium's advantages in mechanized or automated welding uses on stainless, Monel, Inconel and cupro-nickel.

There is little to choose between argon and helium on the basis of their ability to effectively keep atmospheric contamination out of a molten weld pool. In their effect upon the welding arc, too, they are equally suited for various applications.

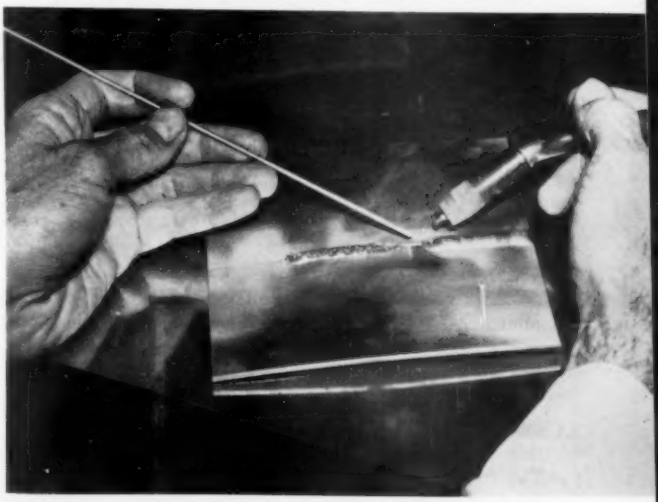
For instance, helium permits a 40% higher arc voltage per unit of arc length to give a hotter arc, better penetration and greater travel speeds; argon, however, allows easier arc starting at low currents. Argon used with a-c in Tig welding aluminum does an excellent job in cleaning the tough surface oxide; helium used with d-c straight polarity gives a more stable and hotter arc than that obtained with argon on a similar current setting.

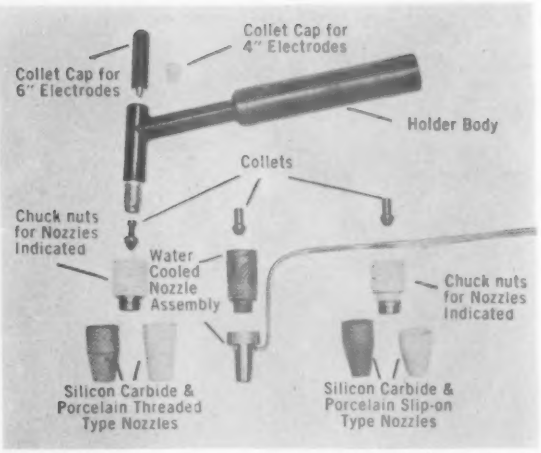
On the basis of both cost and availability, inert-arc users again find a balance between the two gases. Gen-

—*Courtesy Linde Co.*

ABOVE: Heavy welding job is carried out by Tig torch without addition of filler metal on heavy cast part. Weldor must maintain ⅛-in. arc length, but need not create weaving motion.

BELOW: Demonstration with old Tig torch model shows effects of welding without shielding gas (*left*), and with this valuable protection on magnesium sheet.




Collet Cap for 4" Electrodes
Collet Cap for 6" Electrodes
Holder Body
Collets
Chuck nuts for Nozzles Indicated
Water Cooled Nozzle Assembly
Chuck nuts for Nozzles Indicated
Silicon Carbide & Porcelain Threaded Type Nozzles
Silicon Carbide & Porcelain Slip-on Type Nozzles

—Courtesy Air Reduction Sales Co.

TAKE-down view of modern Tig torch shows numerous components for versatile welding use. Torch application at high welding currents requires use of water-cooling assembly shown.

erally, helium is purchased at $8 to $8.50 per 100 cu ft; the price for argon is approximately $10 per 100 cu ft. But argon is available in greater quantities than helium, and it can be used in smaller amounts (*facts which only confound those who try to reason out argon's greater expense—Ed.).*

The nature of work being done is the true selector of shielding gas. A workpiece with high heat conductivity, which must be welded at top speed but with good penetration, is an excellent subject for the very hot helium-shielded arc. In manual operation where heat conductivity is not a severe problem, argon's arc stability is usually preferred.

Available Tig Electrodes

Electrodes used in Tig welding will be one of three types: pure tungsten; thoriated tungsten, or zirconium tungsten. The tungsten electrode was not new to welding at the time the Tig process was introduced: the atomic-hydrogen process had for years used this electrode type in pairs.

Tungsten was chosen for Tig for three very good reasons: it is extremely hard; it had the highest melting point of any known metal—6,150 F, and its tensile strength, even when it has been drawn into wire, approximates 500,000 psi. Tungsten, therefore, is not consumed in the heat of an arc and it does not release any damaging elements into molten weld metal.

Pure tungsten electrodes are recommended for a majority of Tig welding uses, but the service life of this type is not as great as that of the alloyed types. The 1% or 2% thoriated tungsten electrode has greater erosion resistance, and it is also specified for its higher current capacity.

Variable Service Life

Addition of thoria increases the cost of a Tig electrode and makes it even more brittle, but its presence aids in faster arc starting with the *touch* (rather than the *no-contact)* method. Zirconium tungsten electrodes are somewhat more limited in application than either the pure or thoriated types at present. They have produced fine results, however, in welding aluminum on d-c with argon as a shield.

The factors which diminish tungsten electrodes are apparent, but it is no easy matter to gage the *rate* at which the electrode will wear. Service life may be two weeks or two months, depending on the amount of welding being done and on the care given the electrode.

Controls which start the flow of shielding gas moments before an arc is struck are very effective in preventing electrode oxidation and resultant erosion (or *vaporization).* Naturally, when welding operations with the Tig torch are more or less constant, longer electrode lengths will mean fewer changes.

The nozzle through which the electrode protrudes, and from which shielding gas flows, may be ceramic or metal, as noted above. Choice is dependent upon two factors: current and welding conditions.

For welding currents of less than 250 amp, the ceramic cup may be used. But for higher currents, or during those times when welding conditions are severe, the more conductive metal cup should be used to prevent damage to the torch from overheating. Care must be taken in the use of a metal nozzle; if it is brought into contact with the workpiece, a short-circuit will occur which damages the nozzle.

Current for Welding

Because alternating current was an unpopular current type for welding at the time the Tig process was introduced, the early units were operated on d-c straight polarity supplied by a welding generator or rectifier. Today, however, Tig welding is done both with d-c straight and reverse polarity, and with a-c.

Welding transformers supplying alternating current

—Courtesy Linde Co.

USUALLY automated to fully utilize its high speed potential, Tig cutting process is used successfully by this weldor at Graver Tank Mfg. Co. Hole is 11 in. in diameter and was chipped out in one hour. Tig cutter shown could do same job in 45 seconds.

Current selection for Tig welding

MATERIAL	ALTERNATING CURRENT* With High-Frequency Stabilization	DIRECT CURRENT STRAIGHT Polarity	DIRECT CURRENT REVERSE Polarity
Magnesium up to ⅛ in. thick	1	N.R.	2
Magnesium above 3/16 in. thick	1	N.R.	N.R.
Magnesium Castings	1	N.R.	2
Aluminum up to 3/32 in. thick	1	N.R.	2
Aluminum over 3/32 in. thick	1	N.R.	N.R.
Aluminum Castings	1	N.R.	N.R.
Stainless Steel	2	1	N.R.
Brass Alloys	2	1	N.R.
Silicon Copper	N.R.	1	N.R.
Silver	2	1	N.R.
Silver Cladding	1	N.R.	N.R.
Hard-Facing	1	1	N.R.
Cast Iron	2	1	N.R.
Low Carbon Steel, 0.015 to 0.030 in.	2**	1	N.R.
Low Carbon Steel, 0.030 to 0.125 in.	N.R.	1	N.R.
High Carbon Steel, 0.015 to 0.030 in.	2	1	N.R.
High Carbon Steel, 0.030 in. and up	2	1	N.R.
Deoxidized Copper***	N.R.	1	N.R.

KEY: 1. Excellent operation 2. Good operation N.R. Not recommended

**Where a-c is recommended as a second choice, use about 25% higher current than is recommended for DCSP.*

***Do not use a-c on tightly jigged part.*

****Use brazing flux or silicon bronze flux for ¼-in. and thicker.*

Recommended ranges for non-thoriated tungsten electrodes

Electrode Diameter (in.)	Current - Amperes AC (†)	DCSP	DCRP
.020	5-15	5-20	-
.040	10-60	15-80	-
1/16	50-100	70-150	10-20
3/32	100-160	150-250	15-30
1/8	150-210	250-400	25-40
5/32	200-275	400-500	40-55
3/16	250-350	500-800*	55-80
1/4	325-475	800*-1100*	80-125

Recommended ranges for thoriated tungsten electrodes

Electrode Diameter (in.)	Current Range - Amperes ACHF	DCSP	DCRP
0.020	5-20	5-20	-
0.040	15-80	15-80	-
1/16	70-150	70-150	10-20
3/32	140-235	150-250	15-30
1/8	225-325	250-400	25-40
5/32	300-425	400-500	40-55
3/16	400-525*	500-800*	55-80
1/4	500-700*	800*-1100*	80-125

†Maximum values for unbalanced wave transformers. Balanced wave reduces maximum by about 20%.

**These currents exceed rated capacity of any Tig torch.*

must be provided with high-frequency stabilization. At all times, but particularly when welding thin sheets, arc stability is a Tig welding *must*. A high-frequency unit is often built into modern transformers; it can be purchased and superimposed on older machines.

Those a-c transformers that produce a balanced current wave can readily be used at their full rated capacity. But when such a feature is not provided, the primary circuit will become overloaded unless the machines are operated at less than 70 or 75% of rated capacity.

Selection of a current type is based generally on the metal to be welded: d-c is best used on nonferrous applications; ferrous metals are more easily welded with an a-c power source.

Gas and Water Supplies

Both helium and argon are supplied by producers in 240- or 300-cu ft cylinders under pressure varying from 2,200 to 2,640 psi. This gas pressure must be reduced to that required for welding (approximately 20 psi) and passed through the torch at an accurate rate of from 3 to 35 cfh.

Regulators and flowmeters, then, are essential Tig welding components. The two may be installed as a single unit on an argon or helium cylinder, or the gas flowmeter may be part of an automatic unit on which gas and water flow and welding current can be present and instantaneously turned on.

Standard oxygen regulators and flowmeters can be used for both gases. If several cylinders are being used, they can be manifolded; each work area supplied by such a set-up, however, must have its own flowmeter.

Until recently, water was the only coolant for a Tig torch—and was actually responsible for the torch's lightweight insulation. Many torches now utilize natural-draft air cooling, but the water-cooled sets remain most common in numbers.

Clean water is a prime requisite if clogged lines and subsequent overheating are to be avoided. A good filter at the water source will insure this important supply. Wherever water sources are few, however, a wise move is the installation of a recirculation unit which will keep the torch supplied with cool, filtered water and obviate the need for great lengths of hose.

Tig Manipulation

The method of manipulating a manual Tig torch for best welding results has not been altered materially since the process was introduced.

Step 1, the setting of a proper electrode length, must be done with the current *off*. When a butt weld is being made, the electrode should extend approximately 1/8 to 3/16 in. beyond the nozzle *(gas cup)*. Electrode extension is somewhat greater—*i. e.*, 1/4 to 3/8 in.—for fillet welding.

Step 2 is the proper method of striking an arc, and it is a lesson that can be practiced with the current still off. The Tig torch should be held horizontal to the workpiece, and about 2 in. above it. Move the electrode in a sweeping motion toward the work to strike the arc.

When welding with a-c, the electrode should be 1/8 in. above the work at the end of the sweep. Superimposed high frequency will draw an arc. If d-c is used, the electrode must be placed in brief contact with the work, then quickly withdrawn about 1/8 in. to avoid contamination in the weld puddle.

In operation, the weldor turns current on before starting his torch movement, and the sweep must be quick to afford the best possible gas coverage at the moment the arc is struck. *(This is particularly true when the electrode is hot; it will then have a tendency to arc before the torch is in a proper position.)*

An arc can be struck on scrap copper or steel and taken to the work, but this extra effort is needless if the weldor is properly trained in arc starting on the workpiece itself.

Problems With an Arc

Maintaining the best possible arc is **Step 3,** and under certain conditions it demands a high degree of skill. *Arc wandering* is the phrase which best describes the effect of all forces working against the arc.

There are four detrimental forces, two of which—*electrode contamination* and *air drafts*—can be remedied by foresight. *Magnetic effects* and a *low electrode current density* are the remaining forces, and only the latter is commonly encountered.

A sharply zig-zagging arc is indicative of electrode contamination or poor current density. Contamination can be remedied by keeping the electrode out of contact with the weld puddle, or, if the arc is struck away from the work, by using only copper and steel—never carbon.

These firms manufacture Tig welding equipment and supplies

Acro Welder Mfg. Co., Milwaukee, Wis.
Air Reduction Sales Co., New York, N. Y.
American Oxygen Service Corp., Harrison, N. J.
Bernard Welding Equipment Co., Chicago, Ill.
Ceramic Cups, Inc., New York, N. Y.
Diamonite Prod. Div., US Ceramic Tile Co., Canton, Ohio
General Electric Co., York, Pa.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Brothers Co., Troy, Ohio
Lincoln Electric Co., Cleveland, Ohio
Linde Co., New York, N. Y.
Liquid Carbonic Corp., Chicago, Ill.
Metal & Thermit Corp., New York, N. Y.
Mid-States Welder Mfg. Co., Chicago, Ill.
Modern Welding Machine & Equip. Co., New York, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
National Cylinder Gas Co., Chicago, Ill.
National Technical Products, Inc., Englewood, N. J.
North American Philips Co., Inc., Lewiston, Me.
Peck, Cecil C., Co., Cleveland, Ohio
Reid-Avery Co., Baltimore, Md.
Robotron Corp., Detroit, Mich.
Smith, A. O., Corp., Milwaukee, Wis.
Sylvania Electric Products, Inc., Towanda, Pa.
Tec Torch Co., Inc., Carlstadt, N. J.
Welding Apparatus Co., Chicago, Ill.
Westinghouse Electric Corp., Pittsburgh, Pa.

A lack of sufficient current density may also result from electrode contact with carbon and the resultant formation of tungsten carbide—an alloy with a melting point lower than pure tungsten that causes melting of the electrode tip. The amount of welding current being used also may have an adverse affect upon the arc if it is too low. *(Data sheet No. 201 gives recommended current ranges for varying diameters of pure tungsten electrodes.)*

Addition of Filler

Step 4 is the action which must be taken when the arc has been struck, and it differs only slightly from that made with an oxyacetylene torch.

The Tig torch is held at a 45-deg angle from the work after the arc is struck, and the torch is rotated slightly to form a molten puddle. When this puddle is fluid, the weldor begins torch movement along the joint, keeping fluid metal moving with the electrode. *No torch manipulation is necessary unless filler metal is added.*

Filler metals for Tig welding are supplied in rod form, and comprise many types and length. Their addition to a weld joint is accomplished in much the same manner as filler rods are fed in oxyacetylene welding. When a molten puddle has been formed, the torch is withdrawn to the edge of the pool farthest from the point of weld progression.

The filler rod is briefly inserted into the leading edge of the puddle, then quickly withdrawn as the torch moves to this spot and continues farther along the joint. The torch, then, assumes a circular motion and filler rod is added only when the torch is at the rear of the molten pool.

At all times during Tig welding with filler material, the rod should be held at a 15 to 30-deg angle from the work, and the torch at an angle of 45 deg. In other words, there must be at least a 90-deg angle between filler rod and torch.

The Future for Tig

Refinements which have marked the progress of the Tig welding process were, first of all, its automation. The first step in this move toward even higher production adaptability, of course, was the mechanization of Tig through use of manual torches on automatic carriages for straightline or circumferential welds.

Fully automatic Tig equipment has now been available in quantity for several years, but equipment manufacturers see even greater development for their products as new vistas are opened by research in industrial automation.

With modifications, the standard Tig torch was introduced just two years ago as a new cutting tool for nonferrous materials. Finding application principally on aluminum, the Tig cutting development of Linde Co. utilizes the jet-like action of a high-temperature, high-velocity, constricted arc to eject a thin section of molten metal.

Tig spot welding is still another use for the 15-year-old process. Though not capable of joining steel thicknesses greater than approximately $\frac{1}{8}$ in., special Tig spot welding guns now available can quickly weld two pieces of light-gage steel, or a piece of light-gage steel to one of heavier gage. One Tig manufacturer, Tec Torch Co., has now put forth a gun which can be equipped with numerous shield-fixture combinations that permit passage of inert gas and electrode, yet help the weldor position the gun properly for welding.

These developments, plus numerous refinements in all areas, have today made Tig welding the process which can be applied to more metals than any other welding process.

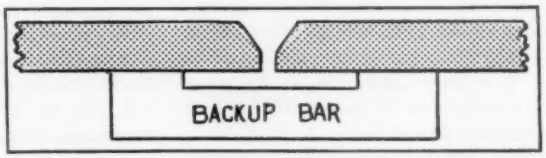
With continued research and broadening applications a certainty, Tig must necessarily continue to be of prime industrial importance in welding's "Tomorrowland."

Should Tig welds be backed up?

A GREAT number of Tig welding applications indicate a need for joint backup. This may be done by placing a conductive metal bar or plate along the underside of the joint; by flooding this area with shielding gas, or by using a flux paste.

The backup bar helps prevent atmospheric contamination; it retains molten metal at the root of the weld; it insures good penetration, and it increases thermal capacity of the joint to prevent excessive base metal warping. Backup bars do not touch the weld zone *(see sketch)*. If they did, the underside of the weld would be rough due to improper penetration.

The choice of material for backup bars is closely related to the type of metal which will be welded over them. For instance, an electrolytic copper bar will be used to back up welds on stainless steel; steel or stainless steel bars will be used when welding aluminum or magnesium.



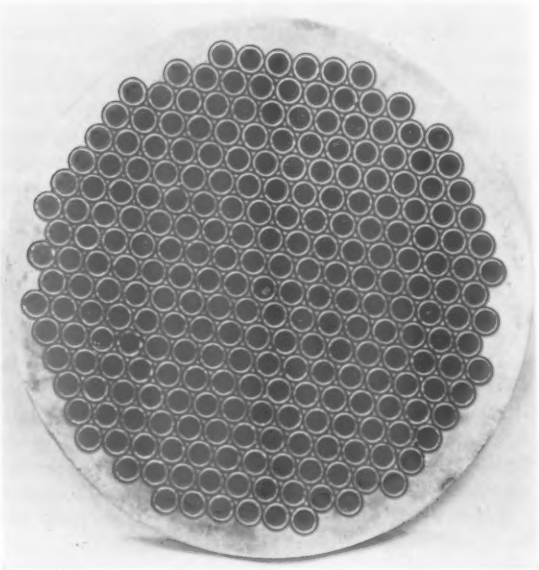
—*Courtesy Linde Co.*

COMMON backup bar. Relief groove is 0.007 to 0.012 in. deep and approximately 10 times wider *(but never less than 3/16 in.)* than thickness of metal welded.

Backup bars are often used in conjunction with a shielding gas, particularly when final weld composition must be very closely controlled. The use of both bar and gas insures complete exclusion of the atmosphere.

When using a shielding gas, it is not always necessary to employ argon. Stainless steel can be backed up with nitrogen, and if there is no danger of explosion, hydrogen can be used with all metals that do not oxidize readily. Those metals that oxidize quickly (*e.g.*, aluminum and magnesium), or react with nitrogen at high temperatures, should be backed up with argon.

Steam surface condensers can keep pace with higher boiler pressures thanks to this Allis-Chalmers welding development.



USED during welding development work at Allis-Chalmers was this 20-in.-diameter tube sheet with ¾-in. tubes.

Speed and ease mark the use of a new Tig gun

By W. W. Edens, W. A. Schumbacker, R. A. Wilson *and* H. Murock*

SOMEWHAT more prosaic than a multi-barrel machne gun . . . or a hornet's nest . . . the welded tube sheet above is nevertheless a major element in today's expanding industrial and nuclear power developments.

It is also an assembly that has given its fabricators a parcel of problems over the years.

One of the principal operational factors of steam surface condensers is the maintenance of tight tube-to-tube sheet seams. Leakage could contaminate condensate and lead to faulty operation of a boiler or turbine —a circumstance not uncommon when tubes were fixed in the sheets with packing and ferrules.

This manner of fastening the nonferrous tubes gave way, in the 1930's, to an expansion-fit method that enlarged tubes at both ends of a condenser. This installation was relatively successful until the trend to higher boiler pressures, "once-through" boilers and nuclear power developments made the tightest possible systems mandatory.

Allis-Chalmers Mfg. Co. answered the need for permanently tight joints, not only by doing the job with Tig (tungsten inert-gas) welding, but by designing its own welding gun for faster, more accurate welding.

Field Fabrication

Before selecting the Tig process for this job, A-C engineers matched the qualifications of many welding processes against these basic design and erection requirements:

(1) The nonferrous alloy sheets and tubes had a successful record of corrosion resistance, and their continued use was desired. Thus, welding process "X" would have to soundly join, for example, Admiralty metal or aluminum brass tubes to Muntz metal or naval brass tube sheets.

(2) All welds had to be made in the field—in the vertical position.

(3) Most welds had to be sound to avoid excessive repair costs. And welded tubes which *were* faulty had to be easily removed and replaced.

(4) The welding process had to be fast so that tube sheets would not be distorted by welding heat.

After careful consideration, A-C felt that only the Tig process could meet these requirements.

Dissimilar Metals

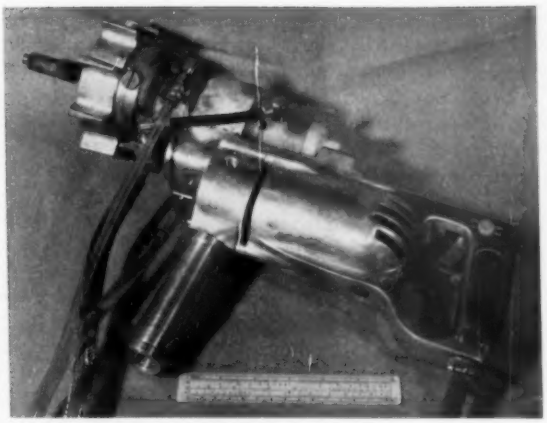
The metals cited above for tubes and sheets are commonly alloyed with such corrosion inhibitors as tin, antimony, phosphorus or arsenic. Wherever cooling water is highly corrosive, the more corrosion-resistant materials of silicon bronze, aluminum bronze, and 70-30 or 90-10 nickel alloys must be used.

Whenever dissimilar metals are welded, with or without filler metal, new alloys are formed in the weld pool. These fusion-zone alloys may not possess properties suitable to the application (*e. g.*, they may have poor resistance to corrosion).

Since widely dissimilar melting points and thermal conductivities could greatly complicate welding, A-C made no attempt to weld metals which had little in common.

In sticking with the yellow-brass family of copper/zinc alloys, A-C actually achieved measurable economy.

**All of the authors are employed by Allis-Chalmers Mfg. Co., Milwaukee, Wis. Mr. Edens is supervisor of the melting metallurgy section in the research laboratories; Mr. Schumbacker is chief technician-in-charge of the welding laboratory; Mr. Wilson is consulting engineer, heat transfer and water conditioning dept., and Mr. Murock is a welding metallurgist in the research laboratories.*



LEFT: A-C technician Tig welds tubes to rectangular test block with new gun. Up to 15,000 tubes must be welded in some steam surface condensers, necessitating semiautomatic operations for greater speed, reduced weldor fatigue. ABOVE: Close-up of welding gun. Light weight, approximate hand-drill proportions, and a-c or d-c usage were design requirements.

This group is cheaper than more highly corrosion-resistant alloys, and it is also available in plate sizes necessary for large tube sheets. Welding slightly dissimilar metals in this family causes only minimal dilution in the weld pool.

Joint Design Factors

Initial experiments involving hundreds of welds with many material combinations were performed on test blocks rectangular in cross-section, 2½ by 12 in., and 1½ in. thick. Holes were drilled through the blocks and various joint preparations were provided.

Tubes were inserted into the holes and aligned for welding. All test welds were checked for soundness by compressed air injected through a hole into the space between tube and block. A soapy water solution spread over the weld area disclosed the presence of leaks.

An illustration with this article pictures three joint types investigated in the Allis-Chalmers laboratory. Joint A was simply a drilled and reamed hole; the tube was inserted in a manner identical to that presently used in expanded-tube fabrication. There were two difficulties with this joint:

(1) Arc heat readily dissipated through the tube sheet, and relatively high welding current *(approximately 190 amp)* was needed for a satisfactory weld. If the arc hit the tube too strongly, the tube melted away from the tube sheet face and had to be removed or repaired. Such repairs were difficult.

(2) Fused metal tended to sag, leaving a lip on the inside surface of the tube. This effectively cut the tube's cross-sectional area and caused turbulence at that point.

Joint B incorporated a taper at the outside face of the tube sheet, eliminating the tube restriction problem. But necessarily excessive welding current still caused frequent tube burnouts. High welding current might have been minimized through use of tube sheet material with lower thermal conductivity *(silicon or aluminum bronze)*, but this would not eliminate tube burn-back.

Since possible substitute alloys had a premium price and were available only in limited sizes, A-C personnel decided on a further refinement of joint design with metals on hand.

Heat Transfer Barrier

The result of additional efforts was Joint C, which retains a taper on the inside to prevent tube restriction, and incorporates a trepanned groove around the hole. This design permits a projection of tube sheet material adjacent to the tube—a desirable condition for relatively easy fusion welding.

The trepanned groove serves as a heat transfer barrier, permitting satisfactory welds with a reduction in welding current of 40 to 50 amp. Heat input to the tube sheet is therefore reduced in two ways, and distortion is minimized. The groove also provides for immediate relief of many welding stresses.

Joint C allows tubes to be easily removed from service with the aid of a portable, air-operated tool that mills away the flared tube end and a portion of the weld nugget. A new tube can then be inserted, properly expanded on the taper against the tube sheet projection, and welded. Three successive tubes can be used in the same hole—an entirely adequate replacement factor for the overall service life of the condenser.

Welding Procedures

All welding during development stages was done with a standard, manual Tig torch. Helium was partially successful as a shielding gas; argon gave the best results, and was used in most of the tests.

Both 3/32 and ⅛-in.-diameter tungsten electrodes were used, and the 1% thoriated type gave good service life. In most cases, direct current in a range from 130 to 150 amp made satisfactory welds.

Optimum welding current was a direct function of the speed at which the arc was moved along the periphery of the tube. For a 1-in.-diameter tube and a total welding cycle of six seconds, optimum current was 130 to 150 amp. When the weld was made

at a faster rate, higher current was necessary to provide equal heat input per unit length of weld.

In the case of aluminum brass tubing in a naval brass tube sheet, best results were achieved with a-c and continuous high-frequency excitation. This combination seemed to break up the oxide film which tended to form on the puddle surface, producing a sounder weld.

All welds were started either from the three or the nine o'clock position, depending upon direction of rotation. In this way, the puddle of molten brass followed the arc downward and fused more readily.

Welding continued for a short distance beyond the full 360 deg of the circle, and the arc was feathered off to minimize possible crater formation where it was broken. Proper gas flow and arc length gave a smooth bright weld.

Production Conditions

After establishment of successful welding procedures on rectangular test blocks and on practice plates, small rectangular heat exchangers were made to simulate production welding conditions. They contained approximately 75 to 100 tubes and required twice as many welds.

Welding completed, an entire assembly was hydraulically tested for leaks. The first unit had two leaky joints that were easily repaired; additional exchangers of this type, when subjected to 50-psi water pressure, proved 100% sound.

A great number of tubes—often as many as 15,000—are to be found in the type of steam surface condenser under study by Allis-Chalmers. The prospect of making up to 30,000 manual welds on these very large condensers led to a consideration of weldor fatigue factors which would definitely influence costs and, in all probability, weld quality.

A-C engineers decided that every effort should be expended to make this welding operation as automatic as possible. With this goal in mind, they conceived, designed and built a new welding gun.

Semiautomatic Welding

Desirable features incorporated into the Allis-Chalmers welder while plans were still on the drawing board were: (1) light weight; (2) *gun* design, with proportions similar to that of an electric drill, and (3) multi-source power unit, supplying a-c or d-c, and with high-frequency excitation for better arc starting with a-c.

The completed welding gun comprises a 110-volt motor, gear reducer, electrode holder, shield, locating device and a trigger-type starting switch. The gun is connected to the power unit by water-cooled cables which supply cooling water and welding current, and by a shielding gas hose and a control cable.

The motor gear reducer combination drives the electrode holder at a rate of 2 to 24 revolutions per minute. Within the usual range of condenser tube diameters, this corresponds to welding speeds of 10 to 90 in. per minute. The electrode holder is adjustable to permit welding of $\frac{3}{4}$ to $1\frac{1}{8}$-in.-diameter tubes.

Weldors and bystanders are protected from arc radiation by the main shield. A standard No. 6 cup around the electrode holder directs high-purity argon to the weld zone. The locating device, a probe on the front of the gun, is inserted into the tube to be welded to insure an electrode rotation that is concentric with the tube.

Self-Contained Unit

The power source is palletized and mounted on rubber wheels. The pallet itself is hollow and serves as a tank for storage of water coolant. A pump at the rear of the pallet provides necessary circulation of water to the welding gun. Gas and water shut-off is automatic.

Two gas cylinders can be placed on the pallet to make the entire unit self-contained and suitable for field service.

The power source should be a 300-amp a-c/d-c machine. A-C's unit provides both current types, plus high frequency and a slope control feature that provides for gradual termination of the arc. Suitable timers and relays are contained in a control box mounted on the welder.

Welder in Operation

When the probe is placed into a tube and the trigger of the welding gun is pulled, this sequence of events takes place:

(1) Gas and water are turned on.

(2) The welding current contactor is closed, high-frequency current begins, and the arc is initiated.

(3) The arc is held stationary about 1.5 seconds to form a molten pool, then the electrode rotates around tube periphery for more than 360 deg of its circumference.

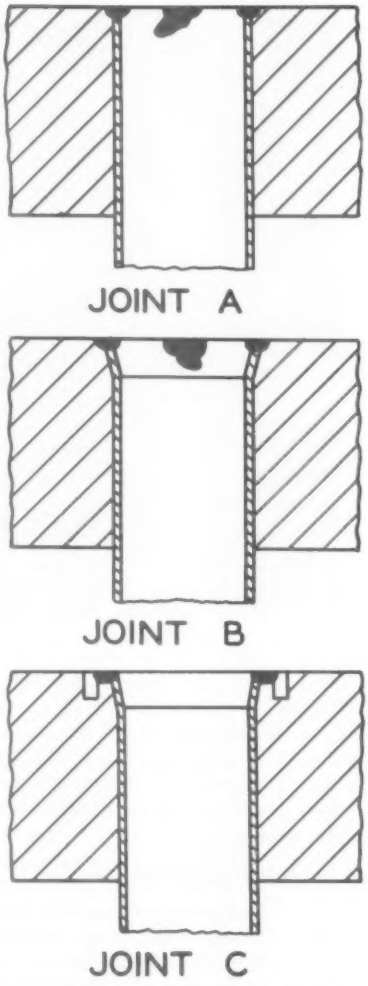
(4) Slope control comes into play and the arc is gradually feathered off.

(5) Gas is shut off.

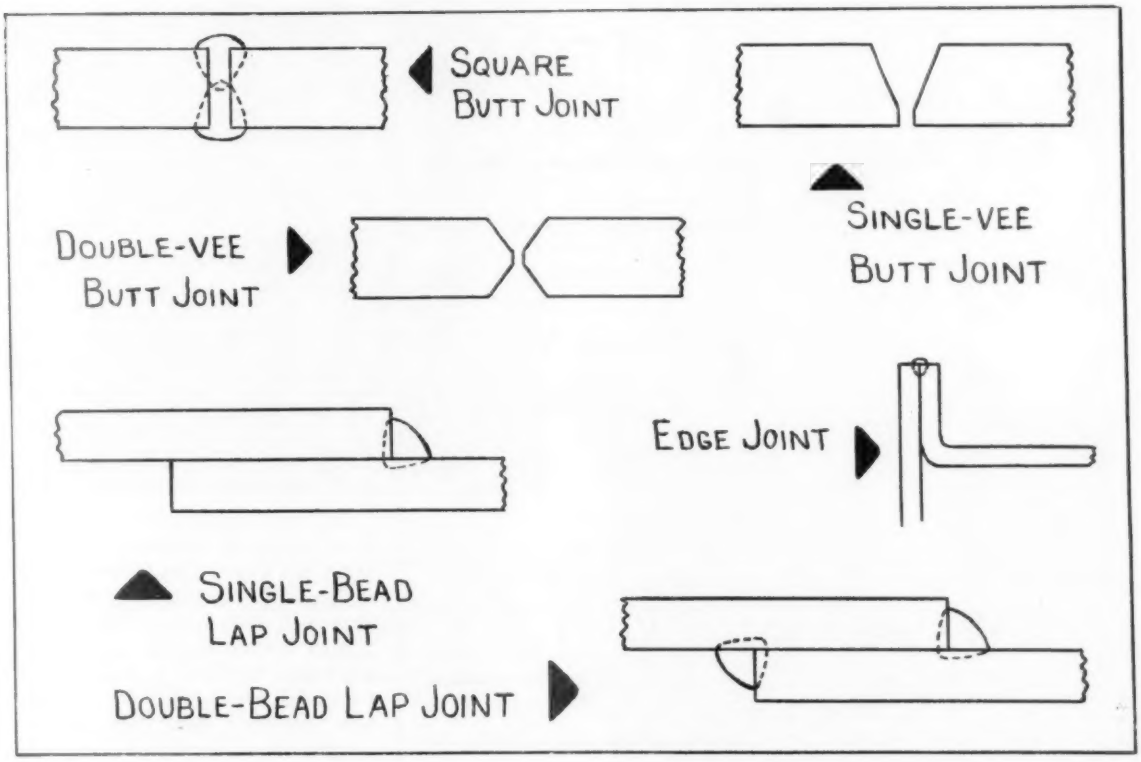
(6) The electrode continues to rotate until it reaches the point at which it began; all welds, then, are initiated in the same position.

Location of a starting point is optional and can be preset on the gun. Although the electrode makes two complete revolutions, it welds only through the first 370 or 380 deg.

Through an evolution of modification and improvement, the Allis-Chalmers welding gun now makes repeated high-quality tube-to-tube sheet welds. It is completely functional and capable of operation under field erection conditions. A number of the guns have already been built and are now in service.



TYPICAL joint preparations ***(see text).***



Select the proper one

Joint designs for Tig welding

SELECTION of a proper joint design for Tig welding is dependent upon virtually the same factors that must be considered for gas welding or other arc welding processes.

When the weldor or designer has taken into consideration (*1*) the type of metal that will be welded; (*2*) physical aspects of the assembly; (*3*) physical properties he desires in the weld, and (*4*) costs inherent in joint preparation and in welding, then he may correctly choose a butt, lap, corner, edge or tee joint.

There are, of course, other joint types, but they are essentially variations of those mentioned.

Use of Filler Rods

Unless he cannot obtain complete fusion without it (and this is often the case when welding heavy materials), a weldor using the Tig process need not employ filler material. When filler must be added for reasons of improved fusion or better joint reinforcement, however, the rod should be applied in the manner described in the article "Tig—for the metals that 'couldn't be welded' " in this issue.

The use of filler metal is optional in a square butt joint unless, as noted above, parts are too thick to be fused with arc heat alone. Fit-up for this inexpensive joint type must be carefully controlled; parts that are out of alignment result in incomplete fusion of all joint-face areas.

Root Gap

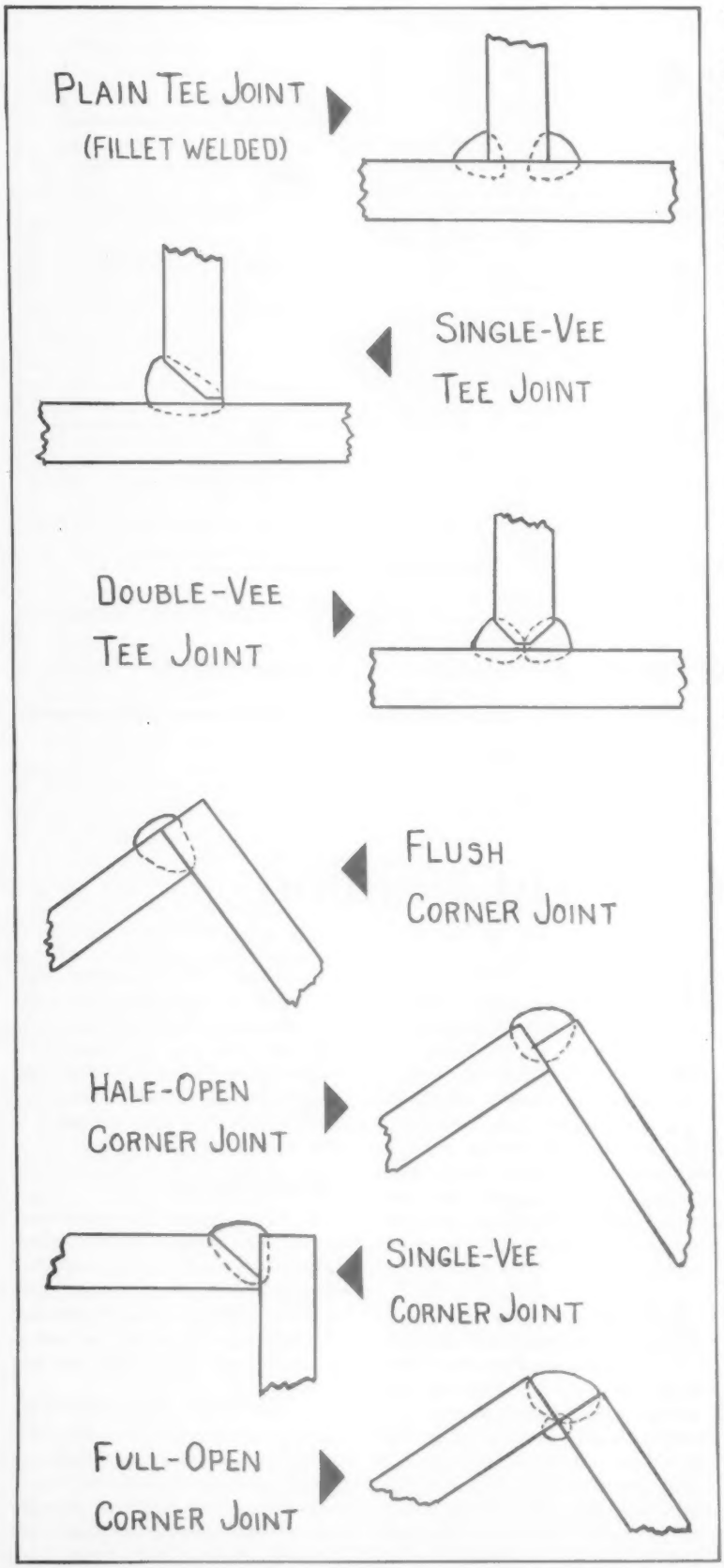
When welding metals that are $\frac{3}{8}$ in. thick, or more, a single-vee butt joint comprising a 60-deg angle is advisable. The beveled plates (*see sketch*) should be aligned in the manner of a butt joint, leaving a slight root gap between the land (*or nose*) of each plate. The land will be about $\frac{1}{8}$ in. on thinner plates, and up to $\frac{1}{4}$ in. on 1-in. plates.

The flange joint illustrated with this article is used only when good fit-up cannot be obtained in a square-edge butt joint . . . and only when material being welded is thin-gage stock (0.065 to 0.085 in.). Normally, filler metal is not required when this joint is used.

Double-Vee Butt

The fourth type of butt joint—one that should always be used when thicker material is being welded—is the double-vee butt. Plate edges are beveled 30 deg or more on each side and comprise at least a 60-deg included angle when fitted up for welding.

The double-vee butt joint is more expensive to prepare, but requires less filler metal, than the single-vee type. A choice between the two must be based on metal thickness, accessibility of both sides of the joint, and cost considerations of machining and



welding operations.

The lap joint is recommended for plates no thicker than ¼ in., for obvious reasons of good design practices (*i.e.*, plates thicker than ¼ in. would be butted). However, if excessive joint thickness can be tolerated, and if the joint will not be subjected to excessive fatigue or high-impact loads, the economical lap joint can be made.

Lap joints may be made either with a single fillet weld, or with a double fillet. The latter method gives greater joint strength, but even this added reinforcement does *not* make the lap joint as desirable as the butt joint.

Corners and Tees

Weldors fabricating containers most frequently encounter the need for corner joints. This joint type may take one of numerous forms: flush, single-vee, half-open or full-open.

Materials less than ⅛ in. thick can be butted to form a flush corner joint and fillet welded on one side only. No filler metal need be used for this simple form of corner joint, but if slightly thicker metals are used in a butted corner joint, both seams will require welding and filler metal is needed.

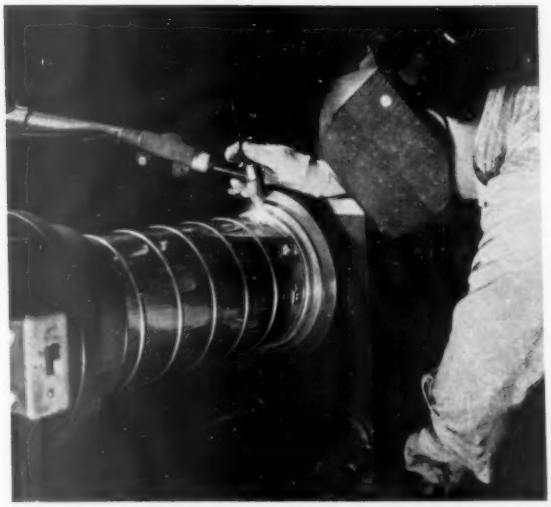
The half-open, single-vee and full-open corner joints are utilized whenever heavy-gage materials are to be joined. Special care must be taken in making the initial pass on these joints to see that burn-through does not occur.

Simple Fillets

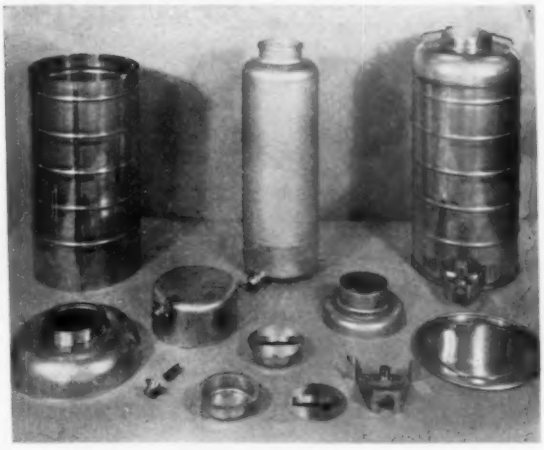
Tee joints of relatively thin material may require only simple fillet welds on both sides of the vertical member—with the addition of filler material for necessary buildup. The vertical member may be given a single or double bevel, however, if its thickness might prevent good penetration and proper fusion.

Edge joints, like flange joints, are restricted to light-gage material, and filler metal is not needed. This joint should not be used where the metal will be subjected to other than normal loading.

Regardless of the joint type selected, workpieces must be thoroughly cleaned before welding. The usual methods of vapor degreasing, grinding, wire brushing, or the use of chemical solvents are all suitable for metals to be Tig welded.



LEFT: Operator guides Tig torch as it makes single pass joining flanged bottom plate to outer jacket of stainless steel coffee jug.



RIGHT: Assembled inner container *(center)*, also welded automatically by Tig method, is placed in outer shell *(left)*. Finished product is at right. Various attachments and other components *(in foreground)* are joined manually by Tig.

For the Air Force

Stainless jugs are Tig welded

FOOD CONTAINER equipment used by our armed forces, like other combat materials, must withstand rough usage. The unglamorous coffee jug is a typical example. (Despite repeated jokes about its quality, coffee served to our troops is important to their morale.)

As in most every other field, welding supplies an answer to the need for hardy construction. Strong stainless steel coffee jugs are Tig (tungsten inert-gas) welded for the Air Force by D K Mfg. Co., Chicago.

Since the use of Tig was inaugurated by D K, no joint failures in jugs have been reported. Previously, it was found that silver-soldered joints did not hold up under field conditions.

The high strength welds produced by Tig welding are also smoother and can be cleaned easily.

302 Stainless Used

The 1 and 2-gallon insulated jugs consist of an inner liner and an outer jacket, both type 302 stainless. Thicknesses are 0.032 in. and 0.025 in. Inner and outer shells each have one longitudinal and two circumferential welds. The external bottom plate is flanged 1/16 in. and edge welded to the outer jacket.

The circular welds are made in a single pass, using a Linde manual torch mounted on a fixture in conjunction with an automatic positioning device that rotates work 360 deg. The mechanized jig is air operated.

Longitudinal welds, also single pass, are made automatically on the same positioner. The workpiece is moved horizontally below the fixed torch.

No Grinding Needed

None of the welds requires grinding, and welding time on the complete unit is only 15 minutes.

An unusual aspect of the production process is the beading (*see photo*) of the outer shell for added strength *after* the weld has been made. Only a strong weld bead could withstand such a procedure . . . this one does. Outer case welds are made in 1½ minutes.

After undergoing a salt spray test, jugs destined for the Air Force are painted. The D K firm also makes jugs and coffee pots for commercial and individual use. These are buffed, rather than painted.

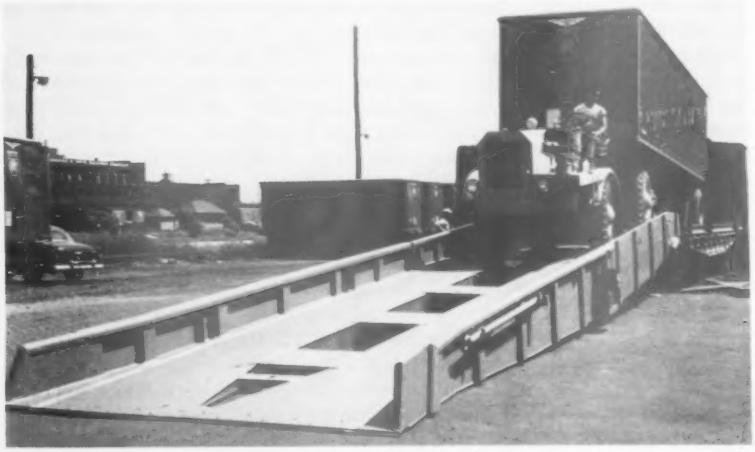
D K uses 15 amp, 20 volts (d-c, straight polarity) on this set-up. Argon is shielding gas, at a flow rate of 10 cfh. The electrode is 1% thoriated tungsten, 1/16 in. in diameter.

In addition to the automatic welds made on the cases, Tig is used manually to join all attachments—lids, spigots, handles, etc.

One square mile of sea water can produce 11,500,000,000 lb of magnesium . . . more than 30 times the amount used in the peak war year of 1943. Properly alloyed and Tig welded, this wonder metal is now forming lightweight but very strong structures for civilian and military consumption.

Tig and magnesium . . . allies in design for strength

MAGNESIUM plates and channels, approximately ⅝ in. thick, are Tig welded to form Magcoa "Dockboard" *(see text)*. Lightweight structure is popular commercial item fabricated by firm because it can take heavy loads *(below)*, yet has a long service life.



By Jack Fairlie

ALTHOUGH the Tig (tungsten inert-gas) process was developed specifically to permit its fabrication, magnesium is only now being given the increased production usage it merits.

Commonly alloyed with aluminum, zinc, thorium or the rare earths to give it structural strength, magnesium possesses an amazing strength-to-weight ratio. But a limited number of producers, coupled with luke-warm designer acceptance, kept the postwar industrial growth of magnesium slowed to a walk.

Magnesium Co. of America, East Chicago, Ind., however, has been anything but apathetic in its approach to magnesium. As a designer and fabricator of many magnesium structures for commercial and military uses Magcoa can offer visible testimony to the varied and valuable uses to which the lightweight metal can be put.

No Risk with Care

Magcoa struck hard at a widespread fallacy that, until very recently, prompted an industrial "go slow" sign on magnesium—that of flammability.

The truth is, the firm pointed out, magnesium alloys won't burn in the atmosphere unless a temperature of at least 1,000 F is *maintained!* Magnesium dust, or a pile of shavings, are naturally more combustible than sheet or plate, but with proper safe-

LADY weldor at Magcoa uses Tig gun to fabricate magnesium alloy door frame for guided missile. Current is 100 amp. a-c, and filler metal is 1/16-in. magnesium rod.

WORKER uses portable grinding wheel to prepare edges of magnesium plate for welding. This plate is type used in dockboard. Resistance spot welding is also used to join magnesium parts at Magcoa.

guards, there should be no chance of fire.

The fact that the very hot Tig arc does not create a fire risk is ample evidence that welded fabrication of magnesium presents no danger.

Just to prove a point, Magcoa cited an instance when 40 or 50 bolts protruding from a magnesium alloy plate were safely flame-cut. This is not the type of job this firm must perform in the course of its normal operations, but it served to indicate just how wrong those who by-pass magnesium for reasons of flammability can be.

Popular Dockboard

Principal item in Magcoa's line of commercial products is a "Dockboard." Fabricated in numerous sizes, the Magcoa dockboard is popular because it can be moved easily, and because it has good service life under severe usage.

Magnesium alloy plates 5/8 in. thick are commonly used in dockboard fabrication, but Tig welds are also made by the firm on material ranging from 0.032 to 2 in. in thickness.

Magcoa's East Chicago plant provides equipment for every operation needed to convert magnesium wrought products into finished goods. There are complete fabricating facilities, including a press room for deep-drawn parts and impact extrusions; the welding section (which also includes resistance spot welders); a paint shop, and laboratories for testing and for continuing magnesium research.

All power sources for Tig welding at Magcoa are a-c types, ranging in size up to 600 amp, and all provide high frequency for better arc starting. Argon is used as shielding gas in every application throughout the plant, and ceramic cups are used on all torches to prevent arc blow spatter.

Since magnesium is seldom joined directly to other metals, galvanic corrosion is not a problem. But stress corrosion does occur, so stress relief of weldments is carried out to prevent possible cracking.

Because of the many contract specifications it must meet, Magcoa is currently boosting its requirements on weldor qualification. Twenty-two weldors are now qualified to weld magnesium or aluminum (which the firm also fabricates) or both. Magcoa's goal: a fully-qualified welding department.

Before selecting the Tig process for all of its arc welding applications, Magcoa studied the advantages of Mig (metal inert-gas) welding and even gave it trial use. The welding results were acceptable, but cost-wise, the process had none of Tig's economy.

The magnesium wire needed for Mig applications had to be purchased at a cost that was 10¢ per pound above the retail price of magnesium filler rod.

150 lb . . . or 35?

"Magnesium's cost—like that of any other product, cheap or costly—must be justified in the application," said Magcoa President Edward S. Christiansen. "Why should anyone select a 150-lb manhole cover that must be lifted time and again when he could pay a little more and get a 35-lb magnesium cover that's just as strong?"

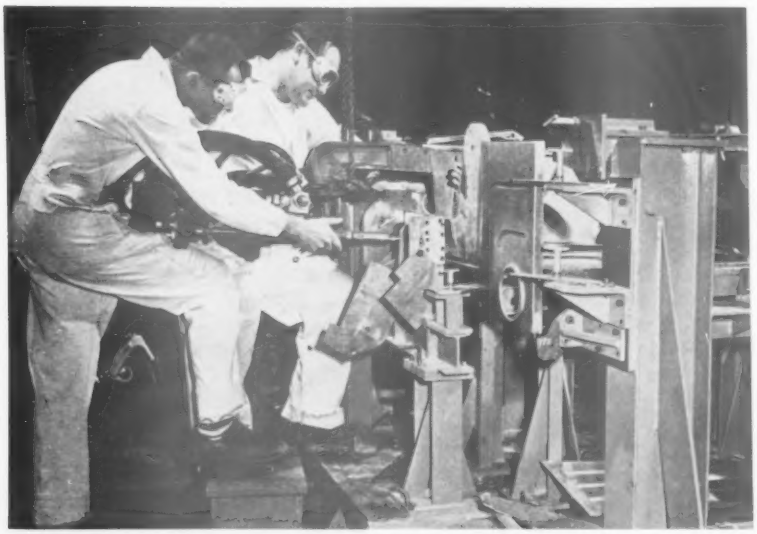
Christiansen pointed up the figures that indicate increased production of magnesium structures. "We're selling this metal's advantages in every way, and it's beginning to pay off. As usage increases, the cost of magnesium fabrications will certainly fall into line with those of other common metals."

And as magnesium alloys find a bigger, more important market, the use of the Tig process must also increase. It stands alone for its speedy and efficient work in joining one of the world's most abundant, but most difficult-to-weld metals.

BODY builders spot weld rear wheelhouse and back panel assembly to frame in fabricating Ford's all-aluminum unitized vehicle body. Portable welder is made of stainless, has 36-in. throat.

It weighs only 124 lb!

Ford spot welds first aluminum truck for the Army



COMPONENTS for truckbody are assembled in steel fixture. Some parts have previously been joined by stationary spot welder.

PARTICIPANTS in an April meeting of the American Society of Body Engineers in Detroit were treated to 4 minutes and 20 seconds of history-making film.

What these men saw on the screen —as it bounded over rough terrain and slammed to the ground 12 times following parachute drops—was the 336-lb steel prototype of the auto industry's first all-aluminum, all-spot welded unitized vehicle body.

Weighing only 124 lb, the XM-151-E2 aluminum military truck was designed and fabricated by Ford Motor Co. engineers. Cooperating on the project were Army Ordnance and Kaiser Aluminum & Chemical Corp. personnel.

Presenting details on the new lightweight all-purpose truck before the ASBE meeting was R. E. Kraemer of Ford's special military vehicles engineering dept.

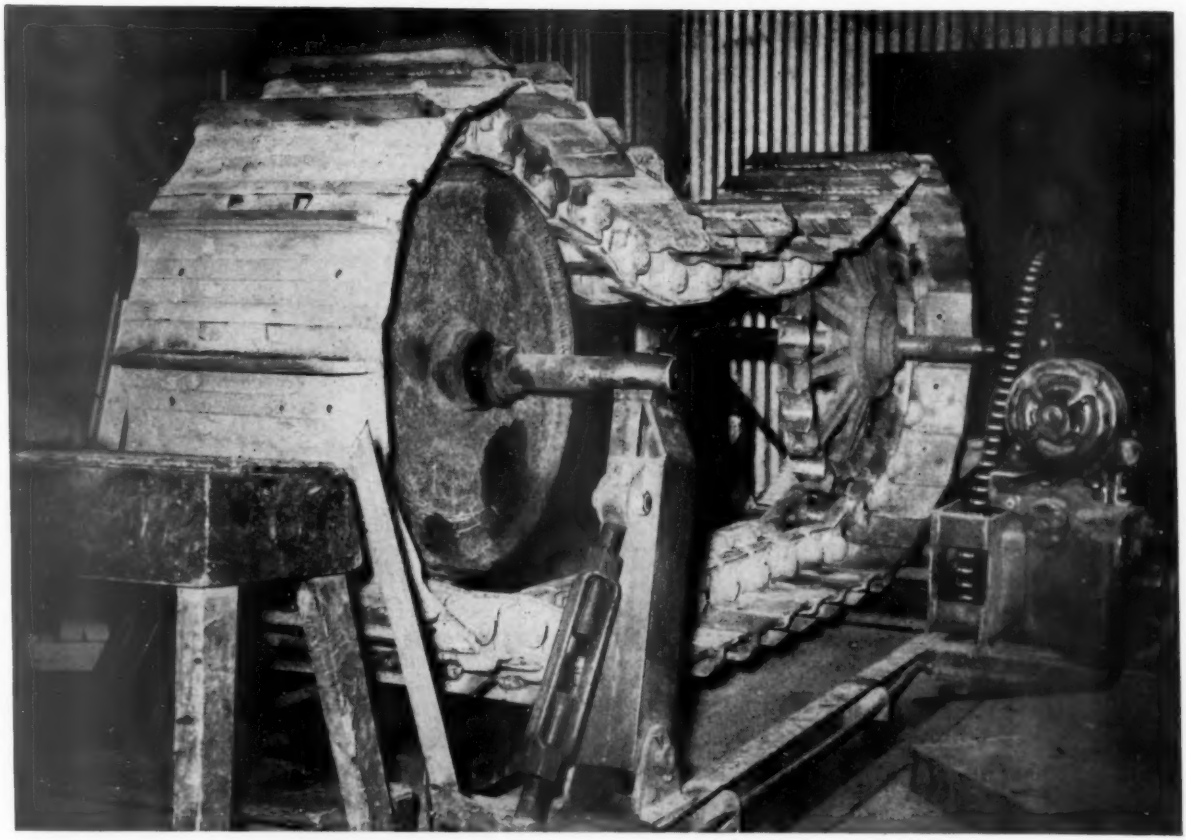
Aluminum By-Passed

Interpreting for his audience the problems that Ford faced, Kraemer pointed out that when the five-year vehicle development contract was awarded to his firm in 1951, aluminum was still considered a critical material. "Use of the lightweight metal was therefore eliminated, and frame stock steel with 36,000 psi yield strength and elongation of 40% in 2 in. was selected for a maximum weight-to-strength ratio," he said.

Using an arbitrary load factor of 5 G's, Ford engineers analyzed apparently critical structural areas in body design. The result of their work was a body in which upper portions *(side and rear panels, front and rear fenders)* carried much of the primary loading. Since steel was being used, this arrangement was satisfactory.

The forming of 90% of body members was done on two and three-piece dies so that walls of structural members and load-supporting panels would not have the uneven appearance of hand-hammered pieces. The steel's relatively low elongation property, however, did result in some wrinkles.

"The selection of parts for the prototype body was done carefully to avoid those parts which had wrinkles, cracks or points of stress concentration," Kraemer stated. All parts chosen for fabrication were then spot welded in accordance with a new military specification developed exclusively for this application. The spec



Positioning Fixture for REBUILDING and HARD-FACING TRACTOR GROUSERS

With spreads operating throughout the Western States from New Mexico to Washington, the Isbell Construction Co. with its head office in Reno has complete facilities for maintenance of heavy earth working equipment at its home base. A fixture for positioning crawler track assemblies to speed the repair of grousers is so ingenious as to have attracted wide attention.

In order to keep their tractors moving, the shop has in stock spare tracks for replacement; when grousers are worn, the track is taken off the crawler and sent to the shops, the replacement assembly is supplied and the tractor goes back to work. The old track is mounted on the fixture shown above and, as time permits, the shop weldors handle the rebuilding job. The fixture has a conventional idler and sprocket on which the track is mounted, the device being adjustable to handle a track assembly of varying length. The sprocket is power driven through a gear reducer.

The assembly is rotated so that a weldor can work on grousers at either end, welding in down hand position. The worn grouser is squared up by a cutting torch and steel bar stock, ½"x1¼", is welded on with high tensile electrodes. After the bar is welded in position a single heavy stringer bead of Stoody Self-Hardening is run across the top to give it extra wear protection.

The company has found that this fixture cuts welding time in half, simplifies handling of the track assembly and the use of hard-facing alloys stretches out service life between track overhauls.

The Stoody Guidebook—the "Bible" of heavy equipment maintenance—is yours for the asking. For your nearest Stoody dealer check the "Yellow Pages" of your phone book or write direct.

STOODY COMPANY

11941 East Slauson Avenue

Whittier, California

permitted the use of high-production techniques.

In testing the steel prototype body, results could be compared only to the vehicle being replaced by the new truck—the M-38A1, with its separate frame and body. After 20,000 miles of durability road tests, plus the parachute drops, small fatigue cracks (*but no structural failures*) were observed.

These cracks wrought a design change in the aluminum truck body to follow. On the whole, however, the XM-151 conclusively proved its very high strength-to-weight ratio.

ONE finger only is needed to keep front fender and cowl assembly aloft. This component weighs less than 20 lb. Completed vehicle is easily transportable by air.

Aluminum Requested

The renewal of Ford's development contract in 1955 brought with it a significant requirement; an additional four XM-151 prototypes were to be designed and developed—and two were to utilize aluminum.

Ford chose 6061-T4 aluminum (*solution heat-treated and naturally aged to a substantially stable condition*) because this alloy with its particular temper seemed best suited for use in the same forming operations used on steel. Gages of the two metals were the same, as were the forming dies.

Said Kraemer: "The 6061-T4 aluminum parts, after forming, attained a minimum yield strength of 11,000 psi (16,000 psi typical). Requirements, however, demanded a material yield strength of 36,000 psi."

To gain desired strength, Ford engineers artificially aged the aluminum after forming to a T6 temper. This was done with a low-temperature heating cycle when body assemblies were placed in a paint oven prior to painting.

In an effort to save time, engineers attempted to place aluminum parts on dies used for steel forming without any rework of the dies. This effort was successful on 10% of the parts—the remaining 90% had to wait until some modification of the die was made.

Rivets Eliminated

"Arc welding, stitching, riveting and spot welding were considered as joining methods," Kraemer revealed. "stitching and riveting were eliminated because they do not provide rigid fastening required for a structure of this kind—they allow joined materials to slip and set up secondary stresses in doing so."

Engineers and designers also had to by-pass arc welding because its heat cycle would diminish hardness in the weld area, and also because it did not lend itself to high-production fabrication.

Spot welding was finally selected for two reasons—(*1*) 6061 aluminum can readily be spot welded, and (*2*) speed of the process would not allow overheating of metal adjacent to the point of welding.

A valuable adjunct to these basic reasons was the familiarity which many development personnel had with the resistance spot welding process.

Kraemer listed four criteria established during development which insured adaptation of the welding procedure to high production:

1. Welds must be made without forging pressures.
2. There would be no certification of weldors or welds.
3. Quality of welds would be determined solely by peel tests and weld nugget analysis.
4. Some practical method of precleaning material before welding would be determined.

Spot Welding Equipment

A peak secondary current of approximately 53,000 amp is needed to form a 0.00180 to 0.00200-in.-diameter weld nugget when spot welding aluminum sheets 0.0060 in. thick. (the thickness of all underbody members). It was current of this intensity that was needed for the application on the aluminum body assembly, but its use was a problem since the aluminum was held in a steel fixture.

To counteract problems before they arose, Ford engineers decided to mobilize the welding transformer so that it could be moved close to the actual welding operation. They also sought equipment which would set up the mildest possible magnetic field in the steel fixture (a need that was particularly crucial when a steel member was encompassed by the throat of the welding gun).

In accomplishing these problem-solving objectives, Kraemer noted, "a three-phase, 250-kva transformer was selected. It has a maximum output of 85,000 amp, sufficient to weld two gages of 0.00102-in.-thick aluminum."

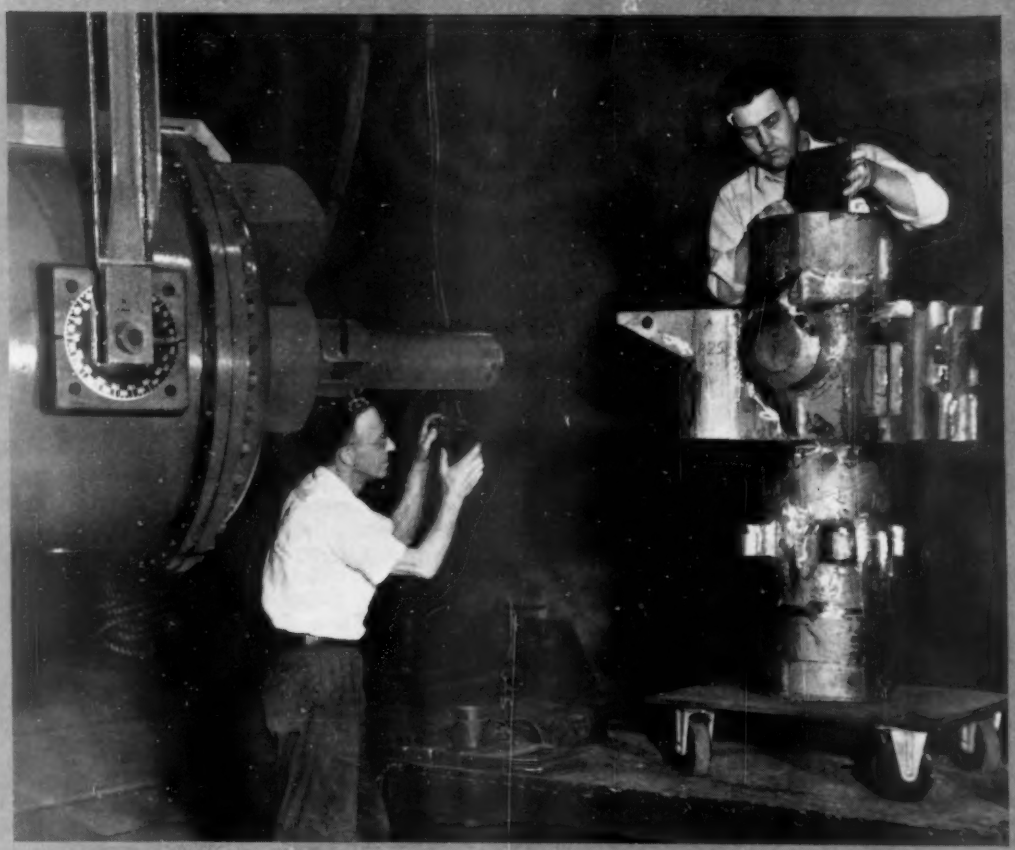
Mounted on a standard stacker, the transformer provides adjustable voltage through a step switch in two ranges: 13 and 26 volts. It is fitted with a control which gives consistent and timed output, and it also has phase shift and slope controls.

Provided for the machine were two types of pressure systems for electrode clamping: a water hydraulic booster giving up to 2,000 lb electrode pressure, and a water hydraulic booster with 1,000-lb oil pressure on the input side to give 7,000-lb electrode pressure. The latter amount, however, was unnecessary, since forging pressure was not required in welding.

Portable Gun Used

A portable spot welding gun with a 36-in. throat was fabricated from stainless steel to withstand high welding pressures. It was connected to the transformer by two 6-ft kickless cables in parallel. The cables had a 600-MCM cross-section.

Before being placed in the fixture as fairly large weldments, many subassemblies were constructed with the aid of a three-phase, 200-kva station-



Watchdog on mounting costs

PRICES of common materials keep going up. Many new alloys are costly. Hence, rough castings become more expensive.

Even more, the cost of machining time keeps mounting. No one can afford to have it wasted by waiting for the tool to locate a void or defect.

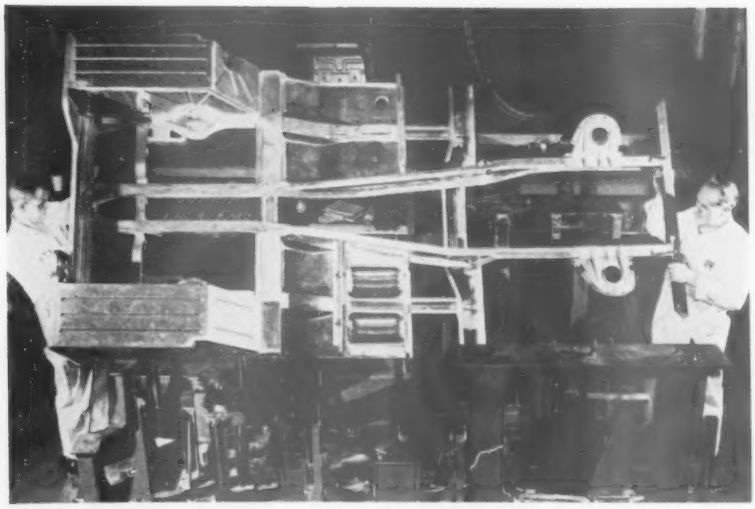
So now is a good time to re-examine the importance of radiography. To suppliers it gives the assurance that only a quality product is delivered. To processors it gives the confidence that man and machine time will be productive—not wasted.

Today, million-volt x-ray equipment radiographs heavier parts with shorter exposures. The use of radioactive isotopes makes possible a radiographic department at moderate cost. And the new Kodak Industrial X-ray Film Type AA—with up to twice the speed of the previous film—widens the scope of all radiographic equipment.

If you would like to know how radiography can save you money—how it can keep the quality of castings high—have a serious talk with your Kodak x-ray dealer or Kodak technical representative.

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Kodak
TRADE MARK



TWO workmen easily reverse portion of aluminum body so other areas to be welded are readily accessible to portable spot welding gun.

ary spot welder. This unit could accommodate a variety of parts in its 48-in. throat.

"Gun tip pressures, current output and timing were checked on sample strips of aluminum," Kraemer reported, "and the welds were given peel tests. The test weld procedure was repeated before each weld sequence began."

Cleaning a Problem

Kraemer admitted that Ford's greatest difficulty arose in cleaning aluminum pieces prior to welding. Wire brushing proved adequate, but when cleaned parts were welded into a sub-assembly, then set aside for several days, they needed additional cleaning before welding could continue.

When three panels had to be welded to each other along the same overlap, the third panel was spot welded at precisely the same spots where the first two panels were joined. Only at this time did oxidation cease to be a problem.

"A production method of cleaning that is less time consuming and more practical than wire brushing must be found," Kraemer stated, "and solution cleaning of all parts prior to welding seems the only certain method at this time."

Another problem which Ford solved in this application was a design for accessible spot weld locations. Larger electrodes and higher tip pressures are needed when spot welding aluminum, and if the electrodes must be severely offset, they may fail under the load.

Final Testing

The heat treatment designed to bring the aluminum body to a T6 state and required yield strength was carried out after the completion of all welding operations. A temperature of 350 F ($\pm$ 5) was maintained for 8 hours.

Placed in the paint oven with the body assembly were sample sheets of the same aluminum used in the body. These pieces were cut to typical tensile test specimens at the end of the heat cycle and subjected to thorough lab tests.

Commented Kraemer: "The sample specimens checked at approximately 36,000 psi, which is equal to the steel used in the steel prototype body."

Pure bending and torsion loads were then applied to the body, and 150 strain gages were distributed throughout the assembly to accurately measure maximum principal stress and its direction. Load factors of 1.0, 2.25, 5 and 5.5 G's were used in the bending test.

"The last load factor of 5.5 G's, when applied to each component and the payload, amounted to a total applied load of 14,000 lb," Kraemer explained. "This load, when compared to the weight of the body (124 lb), means that the body was actually loaded with 113 times its own weight."

Some buckling occurred in side panels under this load, but these panels were not considered structural members. There were no structural failures, but some spot welds failed, Kraemer stated, "with no apparent ill effects" (*a fact which may lead some to wonder if this prototype vehicle, like many other product, is not overdesigned and, subsequently, overwelded—Ed.*).

Better Than Any

Commenting on the new unitized vehicle prior to Kraemer's Detroit address, Arthur Farquette, executive engineer of Ford's special military vehicles dept., termed the welded unit "substantially lighter and stronger, more economical to operate, and better in performance than any comparable military truck."

Farquette stressed the fact that the M-151-E2's center of gravity is 3½ in. lower than that of a present standard quarter-ton truck used by the Army, giving it greater stability. The vehicle accommodates four passengers and has a cargo area 30% greater than that of its predecessor.

Because brake and clutch pedals are suspended, the floorboard is watertight and the vehicle is highly adaptable to flotation on inland waterways.

The XM-151-E2 has its engine, radiator, clutch, transmission and transfer case installed in a single package for easier maintenance, according to Farquette. Also in package form is the front suspension and components (an independent type with coil springs at each wheel), which can be changed in half an hour.

With what Farquette described as a "specially developed 4-cylinder, overhead-valve engine," the new military truck "has a higher top speed and can out-accelerate any current Army vehicle."

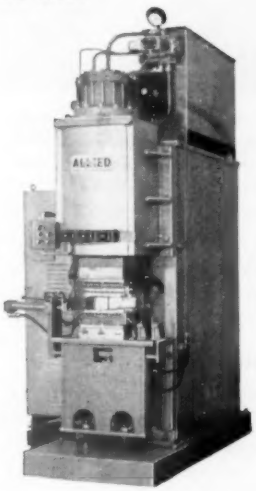
"And as a token of our esteem, some gold-plated slag from your last job."

Since you're looking for better tools . . .

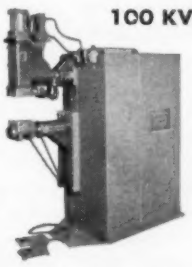
. . . LET'S TALK STANDARD WELDERS!

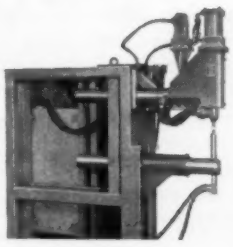
Allied's new roller head press type combination spot and projection welder (lower illustrations) has 8 outstanding advantages. Standard models are approximately one foot less in width than conventional welders, accomplished by placing arms off-center with controls installed within chassis frame where protected. Arms can be installed left or right of center making possible convenient welding of irregular-shaped pieces that fit naturally around corner of machine. Machines with right and left hand mounted arms may be installed adjacent to each other and within 9½" for sequence welding. Arms may be extended by simply loosening 3 screws on casting to give up to 30" throat depth. Vertical adjustment of lower arm up to 15" is provided without changing current characteristics except on air gap since transformer is connected directly to arm support casting instead of mounting plate. By removing 4 bolts, head may be replaced with special adaptations such as multiple guns or projection welding platens. This is done in minutes on the job. Welders are completely water cooled with open or closed circuits. Available in standard sizes: 30, 50 and 75 KVA with 1000 P.S.I. at 80 lbs. line pressure and 75, 100 and 150 KVA with 2300 P.S.I. at 80 lbs. line pressure and on up to 750 KVA in press welders (top). Prices are well below that of conventional welders of equal capacity.

750 KVA



100 KVA

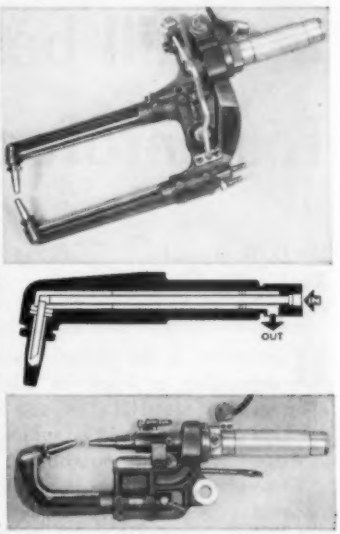




Write for information.

. . . LET'S TALK WELDING GUNS!

Operation so cool you can hold your hand on the jaw extension right below the point is main feature of this new line of portable guns. Incoming water reaches point through tube insulated almost its entire length from metal of jaw by return water jacket which has 5 times capacity of in-flow tube. Heat transfer to the in-flow tube is much less than with small diameter cast-in return water tubes that build up excessive heat in the jaw extension. Use contact fulcrum pin in place of conventional shunt which tends to overheat causing early failure. Built-in guide for moving jaw prevents wear on fulcrum pin if gun is used in cocked position. Line includes "C" and scissors type with upper or lower jaw operating and types for special applications. Guns have been on heavy duty production test for 2 years.



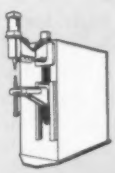
YOUR SPECIAL EQUIPMENT PROBLEM — *HOW BIG IS IT . . . REALLY?*

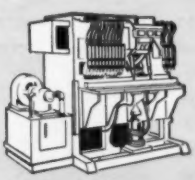
If it involves special equipment for a production welding operation it may not be a problem at all—just an assignment when placed in competent hands.

This is our kind of work—we specialize in it—do it every day; designing and building special machines for welding everything from bathtubs to trailers, frequently including provisions for automatic handling and transfer where the job is a part of a production line set-up.

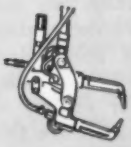
We're no brain trust here at Allied Welder, but we keep some awfully important production people happy with our creative designing and manufacturing know-how—delivery, too.

May we work with you on your next job?


Standard Welders


Special Welders

Automation Equipment


Automatic Arc Welders

Welding Guns

ALLIED WELDER CORPORATION
8700 BRANDT DEARBORN, MICHIGAN

Creative Design

A manufacturer states that to compare hardness and wear characteristics . . .

Field tests are still best for hardfacing

HIGH deposition rates of hardfacing material should not be a weldor's prime concern, the author states. Most materials wear longer if applied at moderate amperage and allowed to cool slowly.

By D. B. Rankin
Rankin Mfg. Co.
Alhambra, Calif.

HARDFACING is the process used in depositing a layer of highly wear resistant material over parts of a machine surface that will be subjected to extremely abrasive conditions.

Wherever hardfacing is used, a machine part can be protected by metal that would otherwise be too brittle to constitute the main body of the part. The surfacing layer is applied either by the arc or the oxy-acetylene welding processes.

Early in the life of the hardfacing industry, efforts were made to evaluate relative worth of hardfacing materials in terms of hardness or total content. These attempts were futile; no quantitative relationships could be established between such arbitrarily chosen features and actual wear patterns.

Another Failure

More recently, research men have attempted to devise a laboratory test to accurately determine relative wearing qualities of various metal surfaces under all conceivable operating conditions. Many test machines have been built and their accuracy tested.

Unfortunately, not one has been universally accepted at this time as capable of accurately measuring absolute wear resistance on a standardized scale. In addition, none of the machines can predict, with complete accuracy, relative wearing characteristics of two metal surfaces under varied conditions.

This article is based on a paper presented by Mr. Rankin at the 10th Western Metal Congress in Los Angeles.

During the course of investigations, unexpected discoveries were made. In one of these findings, it was seen that one metal surface may last much longer than another under one set of abrasive conditions. But the reverse may be true when conditions are altered substantially.

Such phenomena as this seem to preclude the possibility of a universal wear test machine. All that may be expected from laboratories at this time is an estimate of relative abrasion resistance of two materials under the more or less exact conditions of the lab test.

Not in Vain

All the exploratory work in the hardfacing industry has not been in vain. By correlating results obtained from labs with field observations, much has been learned about wear factors gained with numerous alloying combinations—discoveries that have aided product improvement.

At present, the only reliable way of determining a hardfacing rod's ability to do a job—or of comparing it to another rod—is by actual field tests. And when tests are made in the field, these considerations must be kept in mind:

(*1*) Only rods from each manufacturer's line which are suited to the job should be tested against those from competitive lines. Most producers indicate which of their alloys are best fitted for various applications. The user may follow these recommendations, or, if more than one rod is recommended for a specific job, he may have to conduct "elimination tests" to single out the best rod for comparison.

Application Techniques

(*2*) Another important consideration in field testing is *correct application techniques*. Method of applying hardfacing always affects wearing properties of the metal.

The manufacturer can indicate generally which procedures will give best results for each product in his line, but the user must still find techniques for greatest economy of operation.

The first of many welding variables is a machine's polarity setting. If an electrode can be applied on either polarity, straight will give faster deposition rate, less parent metal dilution and higher buildups. On the other hand, most bi-polarity rods operate more smoothly on reverse polarity, giving a thin, smooth deposit with a strong bond.

Another variable is the amperage setting of the welder. Higher amp settings give substantially faster deposition rates—but also overheat parent metal and cause its dilution with overlay metal.

Slow but Sure

Unless the hardfacing rod is designed to operate on high amp settings with reverse polarity (and to be cooled very slowly), high deposition rates should not be the weldor's prime concern. Almost all hardfacing materials give greater toughness with slower cooling.

By measurement, a 3/16-in.-diame-

ter hardfacing rod operating at 175 amp is consumed in 62 seconds. An identical rod of the same material burned off in 76 seconds at 125 amp —a difference of 14 seconds per rod or 1.6 minutes per pound.

To project these figures consider an application on roll shells which requires about 100 lb of metal. Operating at the lower amperage, this job would take 2 1/3 hours longer to complete than it would at a higher machine setting.

The important factor to consider, however, is that welding time increase is inconsequential since parts service life is increased 150 to 300%!

Other welding variables are possible, among them the preference for single or double-pass welds. A double pass increases cost of the operation, but service life of the doubly-hardfaced part can be increased three or four times.

Cost and Quantity

(3) The next consideration in field evaluation of hardfacing rods is the actual quantity of each applied, and the overall cost of applying this amount. Identical *depths* (not necessarily *quantities*) of each rod tested must be laid on the parent metal.

If an accurate record of quantity, rod price and welding cost is kept, the actual cost of doing the job with each rod type can be closely calculated.

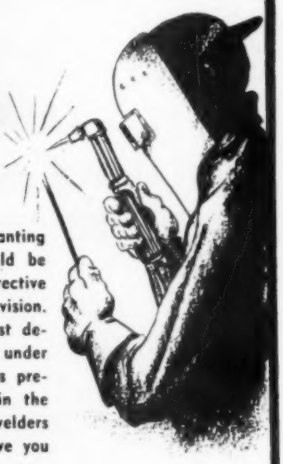
(4) A final consideration in field tests is an accurate estimate of exact work accomplished by each hardfacing rod.

Great care must be exercised in seeing that hardfaced samples receive *precisely* the same amount of wear. A common spot for comparing these materials is on shovel teeth—but unless you are sure that the bucket is digging head-on, samples will not be subjected to equal abrasion.

If shovel teeth aren't precisely parallel to material they will strike, there is no alternative but to coat all teeth with one rod type for a test run, then replace these teeth with others coated by the second material being compared.

There may be exact, quantitative wear resistance tests at some future time. For the present, however, manufacturer and user alike will have to get into the field to gain first-hand knowledge of the strength and relative toughness of all hardfacing materials.

GOOD NEWS for the WELDER *who wears glasses!*



For years welders who wear glasses have been wanting some device whereby their prescription lenses could be worn in the welding hood. Without near point corrective lenses, eyestrain develops, with a consequent loss of vision. MAGNA-LENS correct your vision, magnify the most detailed work. There are no sweaty, smeared glasses under your helmet—MAGNA-LENS is *your* prescription, as prescribed by your vision specialist, and is inserted in the helmet in a plastic frame. Tested and approved by welders doing *all* types of welding! MAGNA-LENS will give you a new outlook on your work!

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No limited training here. Students are given a broad background in this . . .

Prison school for weldors

INSTRUCTOR in oxyacetylene welding puts some of his own advice to work in brazing this small part for machine shop.

By Gerald L. Crofton

WELDING instruction is an integral part of the vocational department's curricula at Michigan State Prison in Jackson.

A combined course in this popular school includes instruction in all welding positions; the use of all brazing methods and alloys; lessons in flame-cutting, and maintenance and fabrication instruction using both arc and oxyacetylene methods.

Total time spent on practical problems by graduates of the course amounts to 540 hours. In addition to this time, 75 hours are devoted to a study of welding theory, and to blueprint reading.

Over 20 classes have been conducted in the past two years, with an average enrollment of 12 students per class. Many graduates, with a solid background of basic experience, have found work in the prison's maintenance welding department, or in the "stamp plant," where they fabricate many items used throughout the institution.

Dining Tables

Among products fabricated by students and graduates of the welding school are more than 150 tables for use in the "trustyland" dining hall. Although the tables have finished wooden tops, their framework is comprised of 2-in. pipes gusseted with ¼-in. plates.

All welds on the table structures were made with E6010 electrodes, employing a portable 300-amp welder as power source. Daily use by hundreds of men has failed to weaken any of the welds.

For the kitchen adjoining this dining hall, three graduate weldors fabricated over 50 ft of stainless steel ventilating hoods for installation over cooking grills. In addition, several large steam tables of 10-gage stainless were welded. Approximately 300 man-hours were required to complete both jobs.

Building-Up Parts

In the welding shop, where student and graduate weldors get an opportunity to put theory into practice, much of the work is centered on the build-up of parts (mostly cast) for the machine shop. Just completed was the build-up of a worn milling machine vise. Three students worked six hours on this project, using the oxyacetylene process and 3 lb of ¼-in. cast iron welding rods.

The "oxyacetylene section" of the school's shop is comprised only of those students who have successfully completed the arc welding course. Instructor Aubrey Moore, a weldor before his imprisonment, hands his students work that needs to be done, but which also gives them the training they need.

Shortly before Christmas each year, the entire vocational school spends most of its time repairing toys

SOME a-c welders used by school stand beside large sketch showing right and wrong electrode angles for weld metal deposition.

STUDENT weldor is all set to work in one of 5 booths serviced by d-c welders. Students learn oxyacetylene method only after passing arc welding course.

collected by outside agencies for needy children who might otherwise not have a visit from Santa.

Brazing and soldering constitutes a large portion of the work done on the broken bicycles, doll buggies, wagons and kiddie cars. Toys are repainted after welding repairs and reach their recipients in first-class shape.

Power Sources

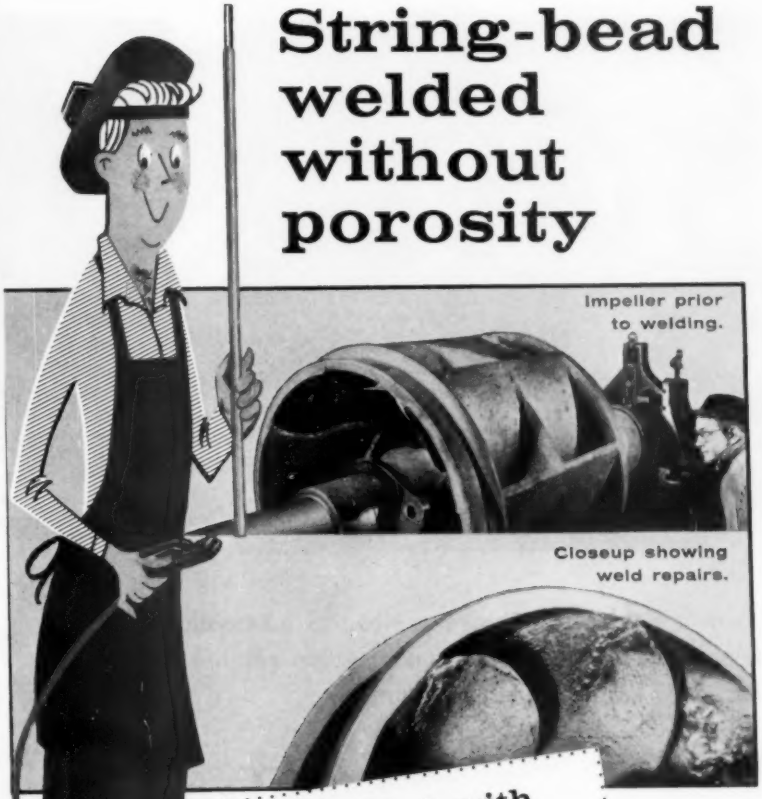
There are 15 machines used as power sources for arc welding done in the welding shop: 7 d-c welders and 8 a-c units. The school also boasts a new combination a-c/d-c constant-potential welder and a radiagraph flame-cutting unit.

At present, the radiagraph machine cuts only test plates, but it will soon be employed in the fabrication of base plates for milling machines used in the prison machine shop.

The satisfaction gained from work accomplished in the welding school is not limited to students alone. Arc welding instructor Chuck Price, recalling the fabrication by student weldors of a hydraulic press now used for face and root bend tests, states that "this press is still as good as the day it was welded. It has never developed a crack."

This press is just one of many fine jobs completed by men who, at one time, might have spent their prison terms in close confinement. Today, they can make the most of an opportunity to develop practical and valuable skills.

String-bead welded without porosity



Welded with Phos-Trode

Ampco's all-purpose phosphor-bronze electrode

Single-and multiple-layer welds were applied to this large centrifugal-pump impeller. Deposits were free from porosity and slag inclusions.

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City_____ Zone____ State_____

—Courtesy Metal & Thermit Corp.

STEPS 1 and 2 in welding process: worker at left checks alignment of clamped rails. Gap is 5/8-in. Mold halves are then centered over joint *(above)*, clamped and packed with thermit molding material.

Thermit welded joints give passengers a smoother ride, reduce track maintenance and lengthen car life for the Cleveland Rapid Transit System.

Trouble spots go out when welded track goes in

By George Polk
General Foreman, Track & Structures
Cleveland (Ohio) Transit System

THERMIT WELDING has played an important role in promoting both passenger comfort and reduced maintenance on Cleveland's new rapid transit system. All trackage is welded by this process, giving continuous rails for smooth riding.

The need for a smooth, fast public transportation system to serve the growing Cleveland area had long been recognized. Nearly 40 years ago, the Van Sweringen brothers, owners of the Nickel Plate Railroad, marked out as a rapid transit right-of-way the natural ravine which their own and other railroads used to enter the city.

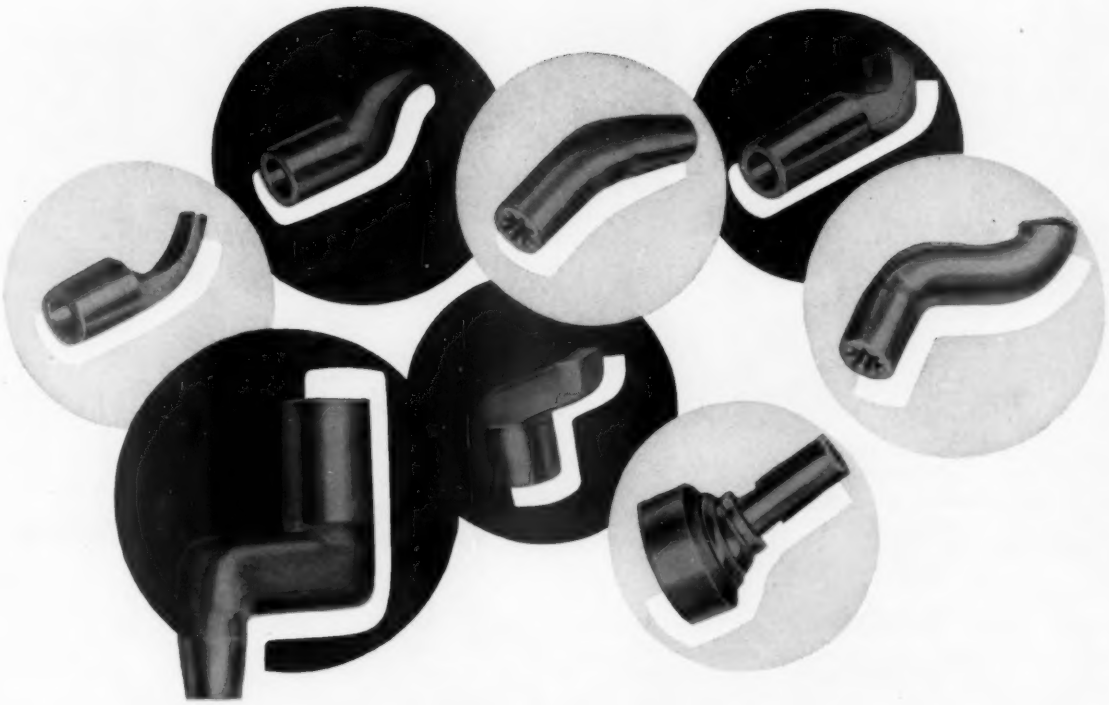
A "Dream Project"

Work was actually begun on the project, but came to an abrupt halt in the great depression of 1929.

The old right-of-way lay abandoned until after World War II, when the original rapid transit plan was revived. Upon authorization of a charter amendment voted by the people, Cleveland's Transit Board broke ground in 1952 for this long awaited "dream project" — a $30,000,000 high-speed transportation system to be paid for entirely with fare-box funds.

The route extends from the heart of populous East Cleveland to a westerly terminal at the border of

IGNITED thermit charge is transformed to molten steel in 30 seconds. Worker taps crucible and molten material flows into joint area. No wax or rail preheat are needed in this operation.



9 times out of 10...

Standard Mallory Tips Fit Your Special Resistance Welding Jobs

Before you order a "special" welding electrode, ask your Mallory welding distributor to check your requirements against hundreds of *standard* Mallory tips. Chances are he'll be able to find exactly the shape and size you need. And he can deliver it promptly—at *standard price!*

The Mallory standard electrode line is the widest anywhere. It includes straight electrodes with many nose shapes, tapers and lengths . . . scores of models of single and double bent electrodes, cold forged for extra hardness and life . . . cast and forged offset types in unusual shapes. Designs include exclusive Mallory features for extra service . . . such as the patented Mallory fluted cooling hole, and bent-in-place cooling tubes. Our electrodes are made with alloys developed during more than thirty years of pioneering in resistance welding materials.

And for that rare job that really needs special treatment, call on Mallory to design and make the custom-tailored electrodes that will give peak economy on your machines.

For prompt service and valuable help, see your local Mallory Welding Distributor. Write for the name of the one serving your area.

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OVER 30 YEARS OF RESISTANCE WELDING LEADERSHIP

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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

WITH mold and packing removed *(above)*, weld cools naturally. Pouring gate is still attached. Portable grinder *(right)* moves along rails to smooth sides and surface around weld area.

Lakewood. Serving 12 stations, the system comprises 13.3 miles of track. Over these rails, 68 high-speed, streamlined cars can flash from one end of Cleveland to the other in 31 minutes. Twelve of the all-metal cars are single units, 28 are double.

Thermit welding was used because it provides several basic advantages. Speed was one, simplicity another. In addition, it requires only small, easily handled, portable equipment.

The thermit welding method proved especially suitable under working conditions peculiar to the right-of-way. Results also showed fundamental benefits: there is no clickety-clack on this welded track—no gaps to jolt cars, no fish plates to fasten, no bolts to tighten.

Longer Service

Thermit welded rails eliminate practically all joint maintenance. No rail ends are open to cupping, cold rolling or other troubles that develop in conventional joints continually pounded by car wheels. Equally important . . . cars encounter no jolting on unbroken rail surfaces, and the service life of rolling stock is thereby increased.

Two particular advantages rendered substantial economies in welding the 8,000 CRTS rail joints:

1—thermit welded joints improve electrical conductivity, yet require no bonding;

2—this form of welding does not rely heavily upon manual skill of the weldor.

Thermit welding is a simple fusion process. Unlike other fusion welding methods, however, it deposits metal in bulk at one time. Size of the weld is governed only by limitations of mold construction and crucible capacity.

Thermit itself is quite inert, being a mechanical mixture of finely divided metallic aluminum and metallurgically processed iron oxide. Manganese, carbon and other alloying elements may be added for specific requirements.

Chemical Reaction

When fired with special ignition powder, a chemical reaction ensues, creating a temperature of 5,000 F. Within 30 seconds, aluminum combines with the oxygen of iron oxide, forming aluminum oxide and leaving metallic iron or, more accurately, steel. Being highly liquid due to intense heat, the steel separates from the aluminum oxide, which floats to the top as slag.

When confined in a mold surrounding two rail ends, as in the CRTS application, molten steel melts joint faces of the parts, fusing rails and weld metal into a homogeneous mass with physical properties equal, or superior, to those of parent metal.

During construction of the CRTS line, welding proceeded speedily and performance records show that crews consistently completed as many as 40 welds daily.

The complete welding operation involved only five simple, basic steps. First, rail ends were aligned and clamped to provide a $\frac{5}{8}$-in. gap. Over this gap, mold halves were clamped. Next, a thermit welding charge was ignited in a crucible supported above the mold.

Finish Grinding

After thermit reacted, the crucible was tapped to allow flow of metal into the mold. Removal of the mold box, of course, promoted cooling of the joint. After sufficient cooling, the rail surface and sides were machined with a portable grinder to produce a smooth, finished joint.

Need for insulated joints in the signal circuits limited length of the longest continuous welded rail sections to one-half mile. All rail welded on this line is 100-lb. ARA-A section with the following typical analysis:

Carbon:	0.67 — 0.80%
Manganese:	0.70 — 1.00
Silicon:	0.10 — 0.23
Sulphur:	* — 0.025 *(max.)*
Phosphorus:	* — 0.04

A thermit mixture that closely matched this chemistry was used, and it provided joints with an average tensile strength of 96,000 psi and a yield strength of 59,200 psi.

The Cleveland Rapid Transit System now carries more than 30,000,000 passengers yearly over welded trackage that assures economical, traffic-free movement of the ever-increasing masses of people who make their living in the growing industrial metropolis of Cleveland.

Any gas,
any job,
. . . from paper-thin
to ingot-thick

The K-G

light • rugged • dependable

M38 TORCH

THIS new M38 cutting torch is designed specifically to give you years of satisfactory and economical service under the toughest shop or field conditions. You can use your M38 for every hand cutting operation . . . using any of the great variety of K-G tips available for standard and special applications.

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The M38 defies flashback. Its design makes it virtually maintenance-free. Ask your K-G distributor to demonstrate the M38, or write to K-G.

all popular lengths, head angles, and lever types available.

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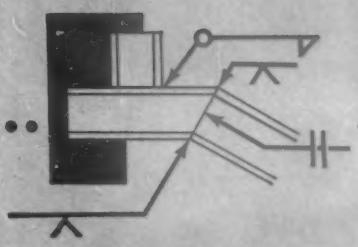
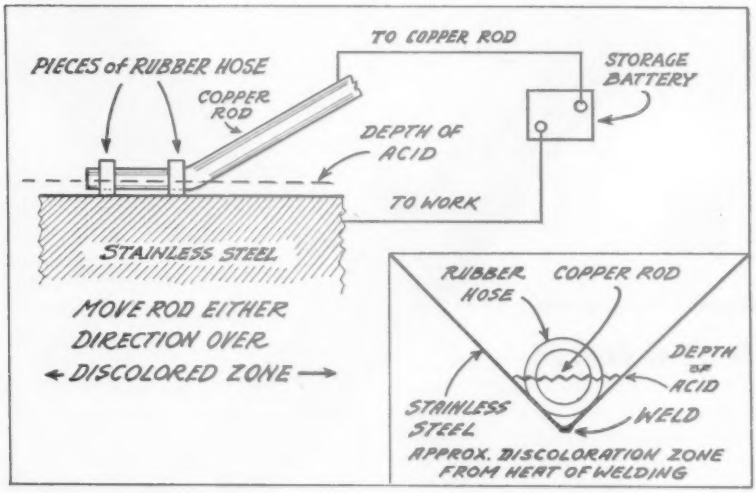


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Removing weld discolorations on stainless



Question:

We have utilized many short-cuts in WELDING ENGINEER *articles for several years, but have not seen any recent advice on the removal of discolorations from stainless steel following silver-brazing. This is a particular problem for us at present, and we would appreciate your advice.*

Answer:

A procedure for the removal of weld discolorations from stainless was suggested recently by Canadian Liquid Air Co. This method requires only a ¼-in-diameter copper rod, rubber tubing, a solution of 50% phosphoric acid and a 6-volt storage battery for d-c power.

The rod should be bent as indicated in the accompanying sketch, and two pieces of the rubber tube are placed over the rod to prevent contact with the stainless.

Just enough acid to wet the discolored surface and contact the rod should be used. The rod is connected to the negative battery terminal, and the stainless workpiece to the positive terminal.

Cleaning is done by moving the rod over the surface at a rate of about 2 ft per minute. Acid should be washed off immediately afterward, and the surface will polish easily. Brighter finishes demand a stronger acid concentration.

If the discolored area is a large one, use copper strip wrapped in an acid-dampened asbestos sheet. A current of 5 to 6 amp per square inch of strip is needed, but current density remains the same.

Question:

We have made moderate use of the Tig (tungsten inert-gas) *welding process in our contract work, but a contract on which we would like to bid requires a lower cost per weld than we can obtain using argon as shielding gas. This job entails welding ⅛-in. cast aluminum collars on aluminum irrigation pipe with an 0.051 in. wall thickness. Since flux is not a problem, would it be possible to do this work with a flux-coated filler rod using carbon dioxide as a shield?*

Answer:

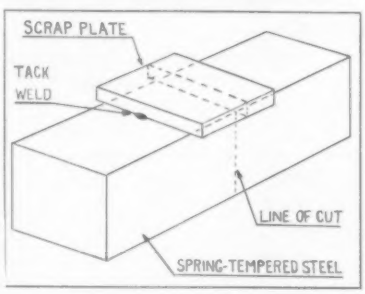
Tig welding aluminum with CO_2 will give rise to more problems than you will be willing to face on a low-cost-per-weld contract job.

If flux is not a problem, why use a shielding gas at all? This work could be done with a standard Tig torch, or with an oxyacetylene or oxyhydrogen welding outfit. Since you already have Tig units, we would suggest that they be used to melt the filler. Proper flux coating will provide all the shielding qualities needed to protect the welds you hope to make.

To the Editors:

For those who flame-cut spring steel, then watch it re-weld itself immediately behind the torch, here's a simple solution:

Lay a piece of cold-rolled iron scrap on top of the spring steel, tack weld it in place (or clamp it), mark the line of cut on both steel and scrap,



and proceed with the job.

For spring steel up to 1 in. in thickness, use a scrap plate approximately ¼ in. thick. Retain this ratio for thicker pieces of steel.

Welding Progress

at METAL & THERMIT CORPORATION • General Offices: Rahway, N. J.

WELDING SUPPLIES
PLATING MATERIALS • ORGANIC COATINGS
CERAMIC MATERIALS • TIN & TIN CHEMICALS
METALS & ALLOYS • HEAVY MELTING SCRAP

EASIER SELECTION OF HARD SURFACING ELECTRODES

Companies in the heavy equipment field are reporting that hard surfacing operations have been simplified and improved with a new line of Hardex electrodes introduced by Metal & Thermit late last year. Matching of hard surfacing deposits to service requirements has been simplified; better physical properties of the overlays lead to increased resistance to wear and reduced maintenance costs. A manual, giving details on hard surfacing systems using the new Hardex Electrodes, is available without cost from Metal & Thermit.

Improvements noted in using these electrodes include decreased porosity in the weld metal, increased resistance to cracking, decreased penetration accompanied by excellent fusion, and decreased weld metal dilution. The reduction of penetration and minimized dilution of weld metal is reported to reduce the amount of surfacing material required to obtain the desired deposit analysis.

A wide variety of hard surfacing requirements is covered by the 16 electrodes in the Hardex line. A manual with a selector chart listing the right Hardex electrode for over 200 hard surfacing applications may be obtained by writing Metal & Thermit. Complete with helpful information on each electrode, it is an invaluable guide to both the weldor and purchaser of hard surfacing electrodes.

Change in Electrodes Solves Stainless Welding Riddle

The proper selection and application of stainless steel electrodes demands a knowledge of the steel being welded as well as the composition of the electrode itself.

A case in point is a Midwestern manufacturer who was joining selenium-bearing stainless fitting to columbium-modified 18-8 stainless, with titanium coated electrodes. Gas was forming in the welds and producing pinholes . . . a phenomena finally attributed to the high titanium content of the electrode coating reacting with the selenium steel. An M&T representative solved the problem by substituting Murex lime-coated stainless electrodes which contained less than 8% titanium oxide.

Metal & Thermit's line of stainless electrodes includes chrome-nickel grades for austenitic and extra low-carbon steels, straight chromium grades for ferritic and martensitic steels. For a complete list of these electrodes and how to apply them write for booklet S-56.

New Welder Rated at 100% Duty Cycle

Long, trouble-free service at a full 100% rated duty cycle is now possible with the M&T Controlled Arc Power Supply recently introduced by Metal & Thermit for automatic welding. With an efficiency of 85%+ and a power factor of 90%+, the C.A.P.S. unit offers lower installation and operating power costs.

Delivering DC welding current at constant, preset voltages, the machine has a built-in arc characteristic control that cushions the effect of current surges, an especially desirable feature in low current density welding of light gauge metals. By reducing wide current fluctuations, the CAPS machine permits deposition of more metal per pass, and improves the overall quality and appearance of the weld. When teamed with a CAPS Constant Speed Wire Feed and gun, the combination provides a complete welding package that reduces the cost of all types of semi- and full-automatic welding. For full details, write to Metal & Thermit Corporation, Rahway, N. J.

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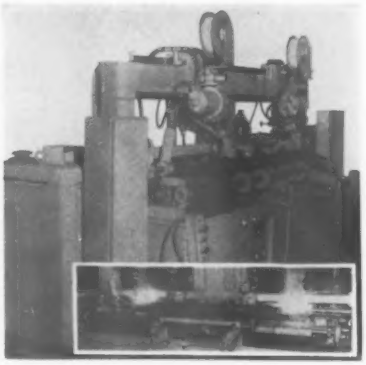

CUSTOM-made for truck manufacturer, Mig welder will produce some drive shafts at rate of 190 per hour, making two welds at once *(inset)*.

Automatic Mig for drive shafts

AN AUTOMATIC Mig (metal inert-gas) welder is performing two joining jobs simultaneously on truck drive shafts. Carbon dioxide is used as the shielding gas.

Designed and built by Dix Engineering Co., Inc., of Lincoln Park (Detroit), Mich., the machine was custom-made for a motor truck manufacturer.

During the unit's operational cycle, a universal joint assembly is welded to one end of a drive tube with a signal circumferential bead. At the same time, a driving splined shaft is welded into the other end of the drive tube.

Depending upon the diameter of drive tubes welded, the machine can complete welding operations in about nine seconds. Dual d-c rectifier sets provide welding power.

Requirements for various trucks demand drive tubes varying in length from 2 in. to 6 ft, and the machine can handle them all. Minor machine adjustments by a single operator reportedly permit production changeovers from drive tubes of different lengths and diameters in just a matter of minutes.

Machine sequences are fully automatic once the operator has loaded assembled parts into the holding fixture. Rated output of the welder is 190 welded tubes per hour (at 80% efficiency).

The tube welder is 8 ft high, weighs approximately 5,000 lb, and occupies a total area of 40 sq ft.

IN THE SHOP

The quick test can be made with Magnaflux, as soon as welds are completed . . . right in the shop, for quick low-cost repair. (Test of welded earthmover bucket arm).

OR IN THE FIELD

Test erected welds anywhere, quickly and easily. Shown is Magnaflux field test on refinery reactor in construction.

Why the Best Welding Practice So Often Includes MAGNAFLUX

By and large, today's welding practices, design factors, and test methods are pointed toward further extending the use of welding as a fabrication method. As a result realistic standards are being established — not severe — which meet measured service requirements to provide consistent satisfactory quality.

Magnaflux gives you the most practical and economical testing systems to meet these requirements, used on any metal. By finding and clearly marking cracks and other common defects, Magnaflux provides a continuous check on the welding performance of men and machines. You can spot troubles fast — and correct them. Experience shows that welders and welding quality both improve with Magnaflux.

What's more, Magnaflux can help you gain new uses and markets for weldments. "Tested by Magnaflux" is generally accepted as evidence that fabrications are fully reliable for the service intended.

When they are *sure* of good welding, engineers can often design functionally better parts that cost less. Needless weight can be safely trimmed. And, in both production and maintenance, Magnaflux reduces scrap by assuring the dependability of salvage welding.

Magnaflux testing is fast and low-cost. It can be used with any method of welding—at full production rates, if that's your need.

Ask to have a Magnaflux Field Engineer explore with you how Magnaflux Testing Systems can improve the quantity and quality of your welding — and save you money, too!

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THE HALLMARK OF QUALITY IN TEST SYSTEMS

PAGE-the welding wire

① WIDE RANGE OF ANALYSES •

• When you standardize on PAGE welding wire for your needs—whether for automatic or manual operation, arc or gas welding—you gain all three of these advantages: *first*, you can secure the exact wire you need from PAGE'S wide analysis range; *second*, we employ many modern methods of packaging for your convenience in handling and use; and *third*, you can count on prompt delivery service from a nearby authorized PAGE Distributor, who is backed by conveniently located PAGE warehouse stocks.

PAGE has unsurpassed facilities, experience and special skills for drawing and furnishing the right wire for your welding applications. We are ideally equipped to manufacture wire to any desired size, temper or surface finish.

We purchase our raw materials to rigid specifications; we select heats of steels for optimum characteristics—then, upon delivery and before processing, we analyze samples for conformity with our specifications. Thus, PAGE is *the one supplier* in a perfect position to control the chemical and physical properties of its product *from billet to rod to wire!*

Solving tough welding problems

We maintain a fully-equipped and competently-staffed Welding Laboratory where constant research in welding-wire development is conducted —and where many solutions have been found to welding problems that hitherto had defied solution. Here are two typical examples:

1 • Good welds on T-1 steel • Making satisfactory submerged arc welds on T-1 steel had long been very difficult—but a special rod developed in the PAGE Welding Laboratory was recently introduced and already has become the established favorite for this application. As welded on mild steel with inert gas, it gives a tensile strength of 80,000 p.s.i. and elongation of 40%. With proper submerged arc flux, it gives as high as 115,000 p.s.i. and 18% elongation, thus closely matching the physicals of T-1 steel. This is the first automatic welding rod ever produced that makes 100% satisfactory welds on T-1 steel. Its characteristics make it a fine rod also for all-around low-alloy welding.

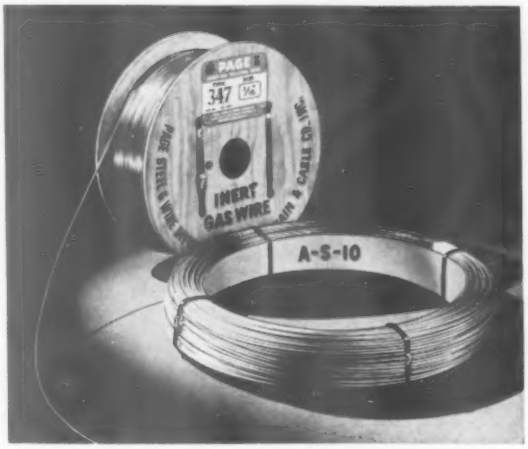
2 • Welding on difficult steels • A manufacturer had been unable to find a welding rod for a weldment that would produce less than 50% rejects. Then he tried a new PAGE alloy rod originally developed for high-temperature (1000° F.) service. Rejects fell practically to zero! Research revealed that this rod, an exclusive PAGE product, possessed properties that make it ideal for difficult low-carbon steels, and particularly in the "hard-to-weld" range from .20 to .45 carbon.

Perhaps you have troublesome weldments on your hands. If so, it will be to your advantage to consult with PAGE.

Write to us at Monessen, Pa., or to the nearest PAGE District Office (opposite page).

Wire to Fill Your Needs— Wide Analysis Range

The PAGE line contains *26 different analyses*, covering the field of applications: heavy automatic submerged arc...light manual submerged arc ...inert gas manual...automatic, tungsten or metal arc.



AUTOMATIC WELDING WIRE

CARBON STEEL... Any carbon from Armco (.025 max.) to high carbon (.70-.84)

LOW ALLOYS... All the most popular welding grades

STAINLESS... All standard AISI grades. Other types on request

GAS WELDING RODS

PAGE Gas Welding Rods have long been recognized as the standard of quality, uniformity and dependable performance. These rods, in an exceptionally wide range, are furnished in coils, on reels or in 36-inch lengths, in the following materials: medium or high carbon steel, mild steel, Armco, low alloy, stainless steel, manganese bronze, naval bronze.

BARE ELECTRODES

PAGE Bare Electrodes are available in any carbon from Armco to high carbon (.70-.84).

METAL SPRAY WIRE

PAGE Metal Spray Wire is supplied in: any carbon from Armco to .80 carbon, low alloy, stainless steel, manganese bronze, naval bronze.

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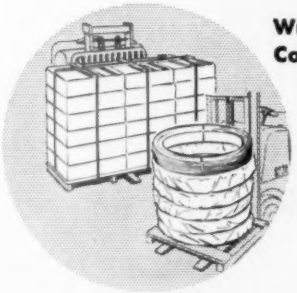
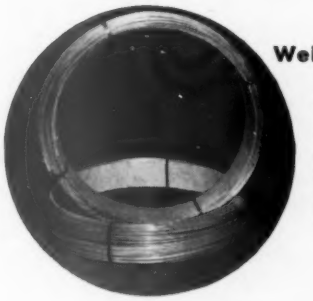


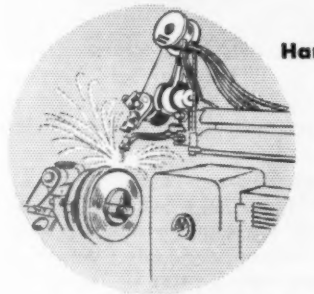
Wrapped Coils... Coils in Cartons

Single and palletized coils, each coil steel-strapped and wrapped in waterproof paper...Also, single and palletized coils in individual cartons.



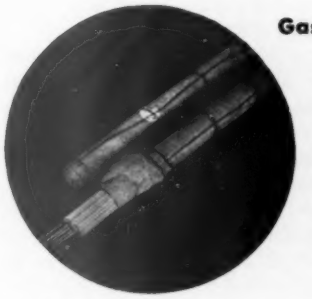
Welding Wire in Coils

PAGE A-S Automatic Welding Wire is regularly furnished in layer-wound coils with cardboard liner, four Signode straps for easy coiling and unwinding—palletized as necessary.



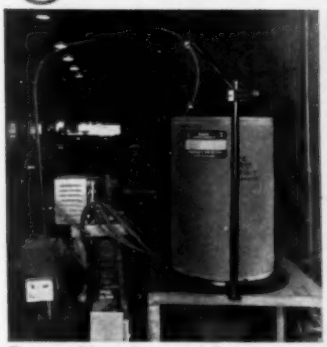
Handy Reels

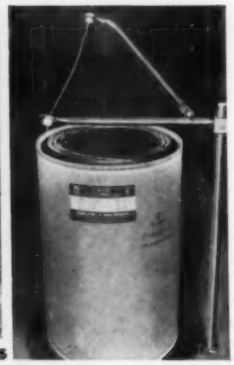
PAGE Inert Gas Welding Wire is available on 25-lb., nonreturnable palletized reels to fit all popular inert-gas welding machines. Wire is precision thread-wound.



Gas Rod Packing

PAGE Gas Welding Rods are supplied in 36" lengths in 50-lb. bundles, paper and burlap-wrapped. Also in burlap-wrapped coils and 150-lb. (approx.) reels. Stainless rods also available in 10-lb. fibre-board cartons.





Pay-off-paks and Leverpaks

PAGE *Pay-off-paks* permit *continuous feeding of wire up to 600 lbs. (from 20" Pak) or 850 lbs. (from 23" Pak) without rethreading.* Wire is properly coiled, free from welds, kinks or twists. *Pay-off-paks* insure uninterrupted production at increased welding speeds. Can be mounted on floor or bench (*see photos above*). Both *Pay-off-paks* and lightweight *Leverpaks* (*not illustrated*) give protection against distortion and corrosion...are easily opened, resealed, handled, stored. Palletized when requested.

Prompt delivery from local stocks

PAGE automatic arc welding wire and oxy-acetylene welding rods are readily available from PAGE warehouses shown at bottom of this page—and from a nearby PAGE Distributor, wherever you live. Your PAGE Distributor saves you time by filling your needs promptly from his stock. This helps keep your inventory investment down!

Send for These...

Folder DH-402A
PAGE Submerged Arc and Inert Gas Welding Wire

Booklet DH-1277
PAGE Gas Welding Rods

Welding Rod Comparison Chart . . . detailing physical properties as welded of various gas, electric, automatic and spray type welding rods—also typical uses of various rods

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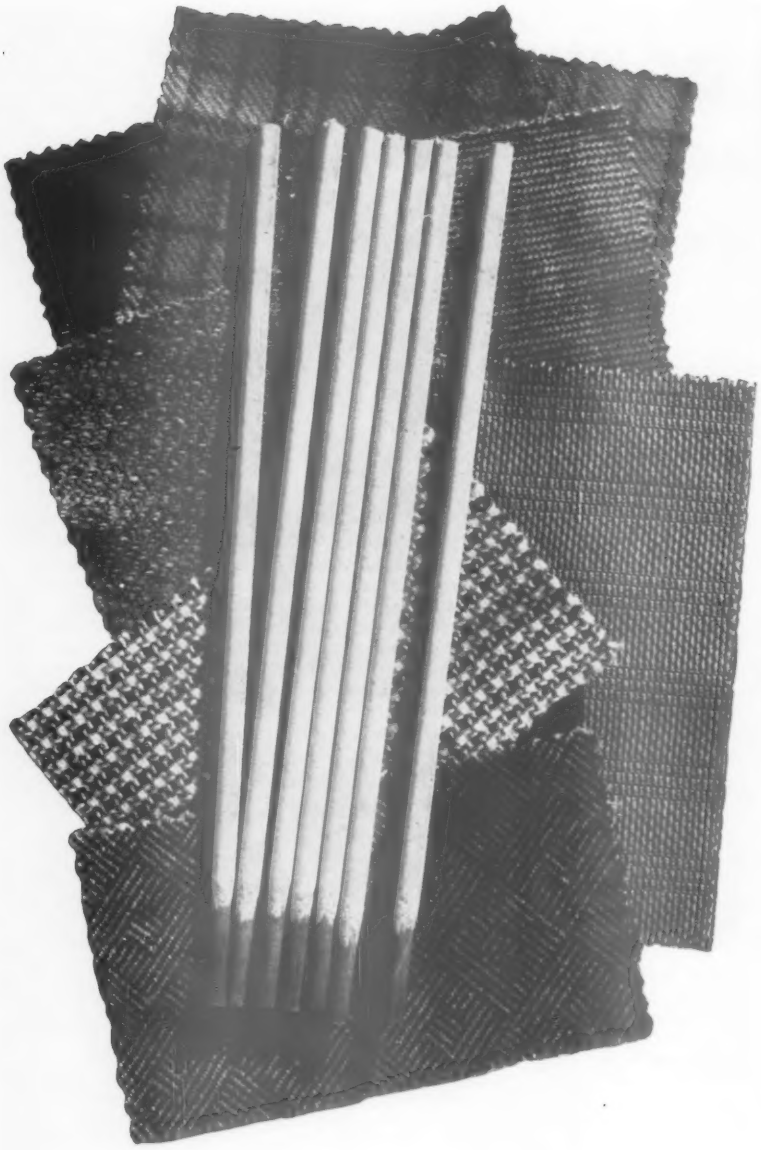
**Indicates PAGE warehouse stocks*



Rod performance is **IN THE COATING**

COATING FORMULATIONS are the key to electrode performance. When RUFLUX* is used in the coating, it provides several important advantages. The particular advantages depend upon which RUFLUX* products are used.

Manufacturers look to TAM for three types. They are the highest quality Rutiles, Titanates and Zirconium compounds. A TAM sales engineer can give you the facts on any one quickly and accurately while a request to our NYC office will bring you detailed literature.

*Reg. T.M.

TAM PRODUCTS
Registered U. S. Pat. Off.
50TH ANNIVERSARY 1906-1956

TITANIUM ALLOY MFG. DIVISION
NATIONAL LEAD COMPANY
Executive and Sales Offices:
111 Broadway, New York City
General Offices, Works and Research Laboratories.
Niagara Falls, New York

WALL thickness is checked before tube end is welded.

Resistance welded gasket tubes

UNIFORM wall thickness in tubing is imperative in the manufacture of "Toruseals" metal O-rings. D. S. D. Mfg. Co., Hamden, Conn., fabricates these static pressure seals by joining and resistance welding the ends of tubing.

Uniformity of wall thickness is particularly difficult to maintain at the weld juncture. D. S. D. achieves this by starting with tubing of close wall tolerance, then exercising special care in welding the ends and grinding off external flash.

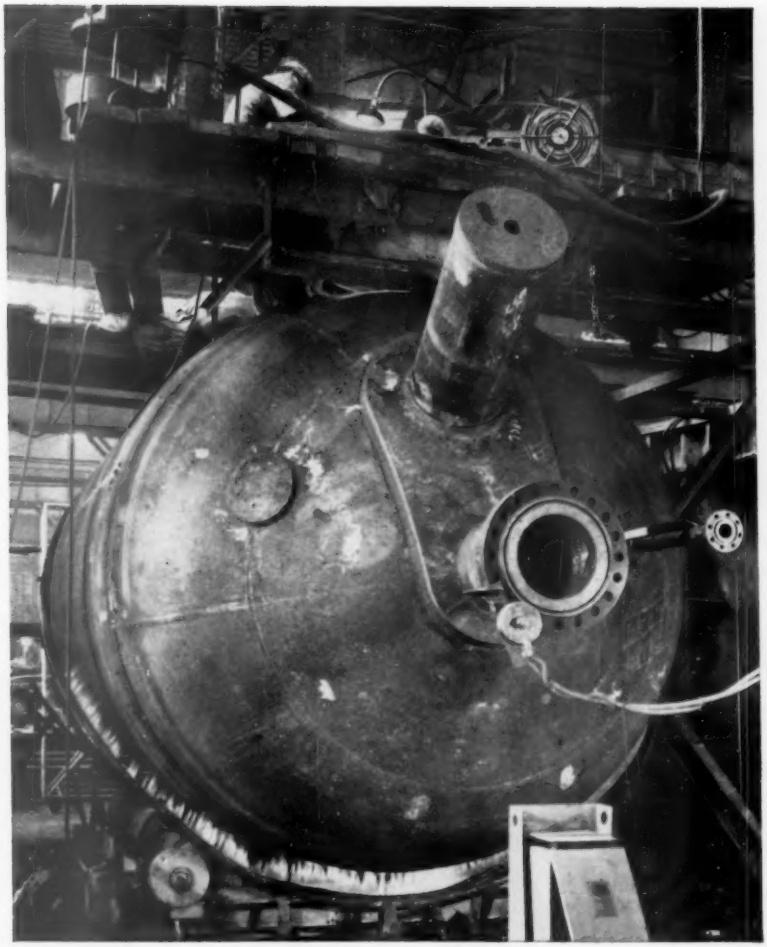
If the tubing wall is too thick, it tends to crack when welded; if too thin, it will burn through. Varying wall thickness would also make it necessary to constantly adjust welding machines.

When joining tube ends, D. S. D. prevents internal upset by a special resistance welding technique. Weld metal buildup would affect deflection pressure when the ring is "squeezed" during installation, and also might dent soft metal fittings.

Type 321 stainless tubing is most commonly used. Produced to aircraft specifications, it must have a clean, bright OD and ID to facilitate welding and must be drawn from stock of closely controlled analysis.

The rings measure ¼ in. to 11 ft in diameter and may be round or shaped. D. S. D. holds diameters to plus or minus 0.005-in. on any size, but can hold to plus 0.005, minus 0.000 when required.

After ring forming, the weld area is given an X-ray and a dye-penetrant inspection check. In addition, samples from each lot are tested to see if they will break at the weld.



When fabrication codes demand 100% X-ray inspection...

SPECIFY *Drawalloy* CORPORATION

Stainless Steel Welding Wire

In hundreds of applications, *Drawalloy* wire has been put to the test . . . X-ray, dye check, pressure and service and with the same consistent result—OK as welded. That's why Frank Iapalucci, Manager of Welding Engineering for Baldwin Lima Hamilton, Eddystone, Penna., selected *Drawalloy* chrome-moly wire for the automatic welds on this reactor. The vessel is constructed of A 301-54T Grade B firebox quality steel ranging in thickness from 5-1/16″ to 2-5/8″. *Drawalloy* 1-1/4 Cr, 1/2 Mo wire was used for all submerged arc joints.

When inspection by X-ray is required, don't gamble . . . rewelding is expensive . . . specify Drawalloy "quality controlled" wire. *Drawalloy* stainless steel welding wire is produced to strictly controlled specifications to provide the right chemistry, finish and temper for smooth operation in your equipment and to provide X-ray quality welds.

Why not discuss your stainless welding wire needs with your *Drawalloy* Distributor or Representative . . . a man ready to help you. Bulletin 355-DC provides complete information on every grade of *Drawalloy* wire. Write to: Drawalloy Corporation, Lincoln Highway West at Alloy Street, York 12, Pennsylvania.

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THE WIRE MILL FOR THE WELDING INDUSTRY — STAINLESS STEEL · HARD SURFACING · TOOL STEEL

Units made by Erickson Power Lift Trucks, Inc., have capacities of from 2000 to 20,000 lbs. Prime requisite of welds must be strength and rigidity to withstand sudden and varying loads.

Putting bonus muscle in a

small but mighty weight lifter

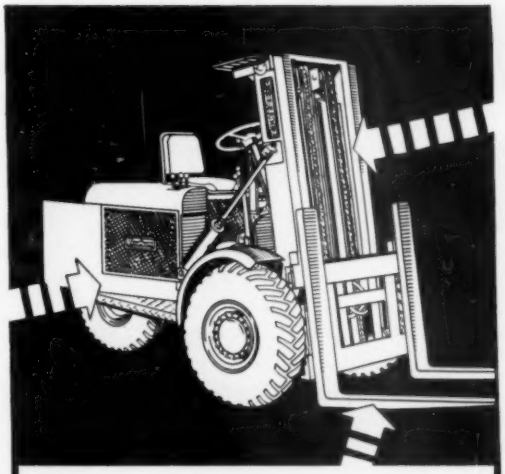
Erickson Power Lift Trucks, Inc., standardizes on versatile, easy-to-use A. O. Smith SW-15 (E-6013) electrodes

MINNEAPOLIS, MINN. — When a company uses one type of electrode exclusively, it's a good indication that their experience has proved those electrodes do a better job at lower overall cost. As George Erickson, Jr., puts it, **"We've standardized on A. O. Smith SW-15 (E-6013) electrodes because we believe that for quality and uniformity, they're the very best available".**

Used on Both Light and Heavy Plate

And no wonder. The SW-15 is a high-production mild steel electrode that can be used with equally good results on light or heavy plate. Weld metal has excellent mechanical properties and good X-ray quality . . . high heat and speeds can be used without risk of undercut . . . and on single pass or finish welds, slag is self-peeling.

If you'd like to know how you, too, can benefit by standardizing on A. O. Smith electrodes, contact your "man from A. O. Smith". He'll be pleased to give you the complete story.



Critical areas requiring extremely high physical standards are indicated. SW-15 meets all requirements.
Typical mechanical properties:

	As Welded	Stress Relieved
Yield Point psi	67,900	65,000
Tensile Strength psi	76,400	72,700
% Elongation in 2"	21.5	24.5
X-Ray Quality		

The man from A. O. Smith . . .

John Rehm is the A. O. Smith welding consultant who worked with Erickson. More than a salesman, he's a welding specialist, ready and eager to help with any welding problems.

Through research A.O. Smith *. . . a better way*

A.O.Smith

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with MERRILL
MATERIAL
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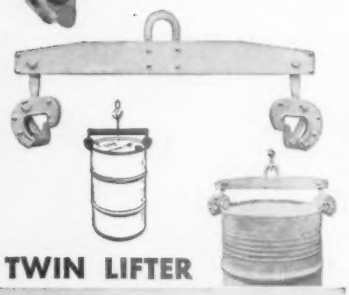


For Interesting Information write

MERRILL BROTHERS

56-81 Arnold Ave., Maspeth, N. Y.

3-7-6

STEEL form for pouring septic tanks is one of fabricating jobs undertaken by Robert Cassidy's job shop in Lordstown, Ohio. Locking mechanism, being unlatched here by Cassidy, is one of many parts welded to tank assembly.

Septic tank forms are arc welded

By a Staff Member

ARE YOU a welding job shop owner looking for a new product to market? You might do well to consider the type of unit fabricated by Lordstown (Ohio) Welding & Fabricating Co., especially if you're in an area where home construction abounds.

The Lordstown firm, owned by Robert Cassidy, fabricates a steel form used in pouring concrete septic tanks. The oblong assembly is pictured above, although the inner steel shell is not visible. When the inner wall is elevated slightly from the bottom of a hole, concrete can be poured for a septic tank floor.

The form is made from four sheets of 7-gage mild steel—two to an inner shell, two to an outer shell. The oblong-formed sheets are reinforced by welding three complete channels of 3-in. rolled materials to the peripheries of inner and outer shells.

Aligning Tabs

The middle sections—where greatest pressure is experienced when pouring concrete into the mold—are additionally reinforced with two shorter channels (see photo).

Locking mechanisms, hanger loops, aligning tabs for abutting sections, and other accessories are also welded to the assembly.

The rolled channel sections are welded to the walls with E6010 electrodes ⅛ in. in diameter. Source of power is a gas-engine-drive welder. Normal current setting for this particular job ranges from 120 to 135 amp.

Channels are joined to the walls through use of intermittent 2-in. welds on 6-in. centers. A complete assembly will necessitate about 25 lb of weld metal. Outer length of the form is 8½ ft.

Cost Reduction

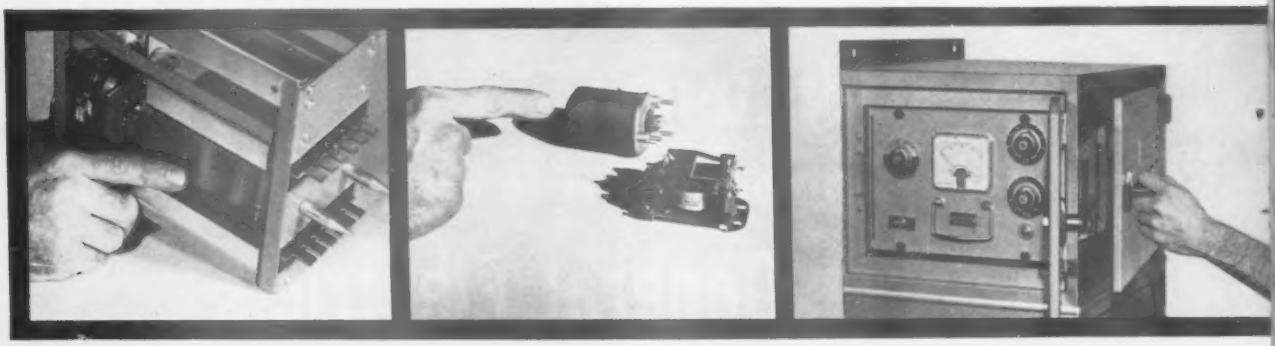
Since both the inner and outer shells must be collapsible (to allow removal after concrete begins to set), the shop often finds it difficult to hold the form to its regular dimensions. Cassidy said he may begin to weld the two extra stiffening channels completely around the periphery.

The Lordstown shop has sold several such forms to septic-tank contractors this past summer for prices ranging from $1,000 to $1,200.

Cassidy intends to market a smaller but similar type of form for pouring concrete walls when elevating manholes in street repair. A concrete form such as this will help eliminate the more current and costly method of building up manhole walls by laying brick.

ANNOUNCING
today's biggest news in resistance welding . . .
General Electric's
NEW non-synchronous control
GENERAL ELECTRIC

NOW G-E RESISTANCE-WELDING CONTROLS come in two lines to meet *any* non-synchronous application. *Standardline* combinations—using standard NEMA sequence timers—are specifically for normal welding applications. *Customline* combinations use unit timers to provide any control sequence needed on special-purpose, multi-electrode, or automated machines.



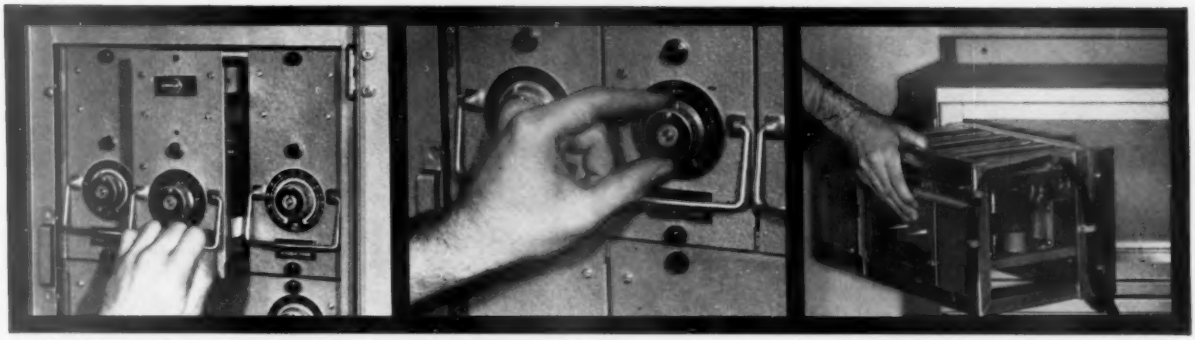
4 **CIRCUMFERENTIAL ARRANGEMENT** of circuit components permits easy accessibility and quick replacement.

5 **HERMETICALLY SEALED RELAYS**—another G-E exclusive—eliminate dirt, moisture and corrosion problems.

6 **FLUSH-MOUNTED ACCESS DOORS** on front and side of enclosure increase accessibility to units and circuitry.

Specify General Electric's NEW *cost-cutting* non-synchronous controls for your next resistance welding application. For more information, write to Section 794-1, General Electric Co., Schenectady, N. Y., for bulletins GEA-6408 (Standardline) and GEA-6593 (Customline). *Specialty Control Dept., Waynesboro, Va.*

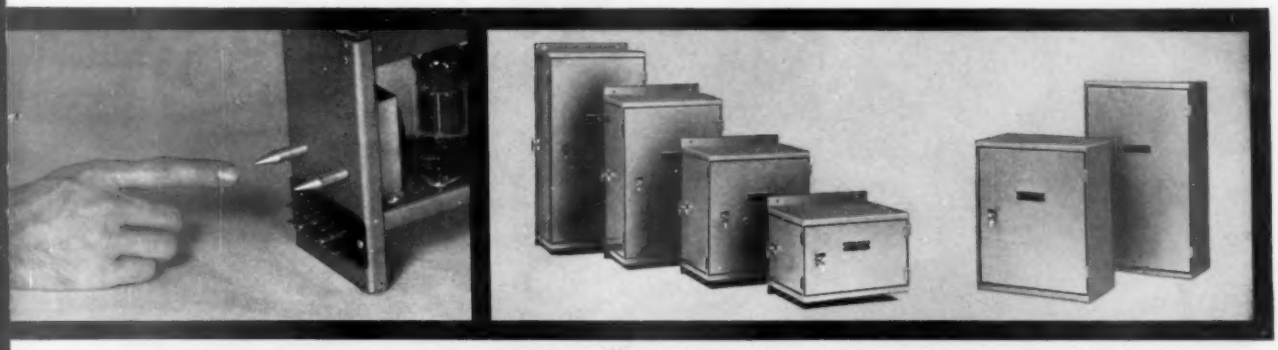
8 reasons why General Electric's new full line of non-synchronous controls can cut your resistance-welding costs



1 **DRAWER-TYPE PLUG-IN UNITS**—used throughout—provide you complete flexibility and greater accessibilty.

2 **EXPANDED DIALS**—easy to read—permit accurate setting of short time cycles for consistent weld results.

3 **SWING-OUT FRAMES**—exclusive General Electric feature—speed installation, inspection and maintenance.

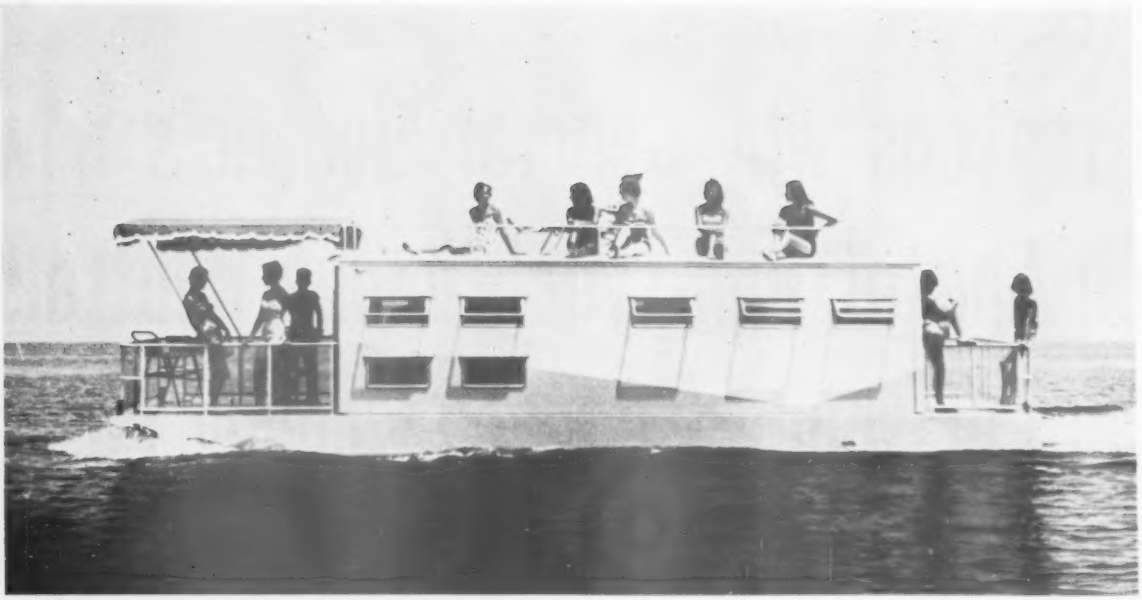


7 **TAPERED GUIDE-PINS**—part of the timer—assure positive alignment, speed installation and replacement.

8 **FULL-LINE SELECTION**—choice of 4 control cases and 2 contactor cases—means you can buy for present and future needs! "Building-block" design gives maximum flexibility for assembly of combinations, a simple way to add control.

Progress Is Our Most Important Product

GENERAL ELECTRIC



WHATTA life! And here's a cargo any pirate would have given his bullion to capture. For a long life in shallow waters, houseboats like this are all welded.

For that home away from home . . .

Welding turns out a rugged houseboat

USING a ⅛-in. E6012 electrode, weldor joins 2-in. pipe with ¼-in. wall thickness to top side of bottom hull plate. Deck plating is joined to top of pipe and bow then has appearance like that on a scow.

By F. T. Tancula

THAT HOUSEBOAT you see pictured above (you *do* see it, don't you?) is another example of welding's advantages.

All-welded steel hulls and decks assure a lifetime free of leaks. Manufactured by River Queen Boats, Inc., of Gary, Ind., the houseboats are available in 24-ft and 30-ft models. All are 8 ft wide.

A spokesman for the firm, R. J. Peterson, credits welding with being the "cheapest and quickest means of fabricating the boats."

"And it (welding) takes a lot of punishment," he added. The boats are thus able to endure years of rough usage in shallow waters.

Lapped Sheets

Hull and deck sheets are 12-gage hot-rolled mild steel. The side walls of the hull are formed (in a press brake) into deep-web, small-flange

channels. The bottom hull plate is a series of 12-ft by 4-ft sheets lapped and welded together.

Reinforcing members are rectangular tubes 2½ in. by 1¾ in., with a wall thickness of 0.065 in. This tubing is set transversely across the steel sheets at 15-in. intervals. Tubes are then welded to the bottom sheets—a 1-in. bead is laid on 4-in. centers.

All welding is manual, employing E6012 electrodes ⅛ in. in diameter at a current setting of 100-120 amp. Power source is a-c.

Here is the production sequence:

(1) Four 12 by 4-ft steel sheets are lapped and welded.

(2) Reinforcing tubes are then joined to the top side of the bottom hull plate.

(3) Side panels (channel members) are welded to this hull plate with fillets. But panel and sheets are not welded their full lengths at this stage because:

(4) A 2-in. pipe is welded to the nose, so that the bottom plate can be brought up and joined to it—forming a scow bow.

(5) The deck sheeting is then welded to side members.

(6) The boat is turned over on its deck, and side panels at the nose are trimmed with an oxyacetylene torch to follow the newly-formed contour of the scow bow. The sides are then lapped over the bottom plate and welded.

Other welds found on River Queens are those joining the steel railings and the ladders. Both are made from ¾-in. black-iron pipe.

RECTANGULAR tubes, serving as reinforcement, are welded to lapped bottom sheets and to side members by this crew of four weldors. All welds on River Queen houseboats are made by manual arc process. Note man in background finishing welds with grinding wheel.

CHANNELS that form side panels of hull are reinforced against warpage with angle iron at point where scow bow will begin to take shape.

INTERIOR view of furnished houseboat is an attractive sight. Bunks are ship-style, but galley offers home conveniences.

IT'S THE *MOST

ANNOUNCING

the Sensational *NEW*

miller GOLD STAR SR

It ***DELIVERS*** maximum arc stability for:

a. Sounder, denser welds – and more of them – in less time, with . . .

b. ALL electrodes, in . . .

c. Any and all positions

How is this performance possible? THE MILLER GOLD STAR SR introduces a...

NEW transformer

plus

NEW weld stabilized current

plus

NEW completely sealed semi-metallic rectifier

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Tested across the country by practical, critical, hard-bitten working weldors, here's what they say about the new Miller GOLD STAR SR:

"it's the DC performance I've always wanted"
"here's DC welding current that's . . . perfect!"
"positively handles ALL electrodes better"
"best deal I've seen for v and o work"
"easiest arc starting in my experience"
"smoothest arc I ever used . . . and . . . quiet!"
* "it's just plain the MOST"

Complete particulars on the MILLER GOLD STAR SR, including inert gas and automatic fixture welding, is now available on request.

". . . If it's Miller you know it's the finest . . ."

miller ELECTRIC MANUFACTURING CO., INC. APPLETON, WISCONSIN

distributed in Canada by CANADIAN LIQUID AIR CO., LTD. Montreal

"IT'S THE MOST*"

DC WELDER IS NOW BEING DEMONSTRATED . . . by Miller distributors listed below. See for yourself how the Miller GOLD STAR SR **delivers** the greatest over-all improvement in DC welding performance **ever advanced by a single machine!**

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☆ See the miller GOLD STAR SR here ☆

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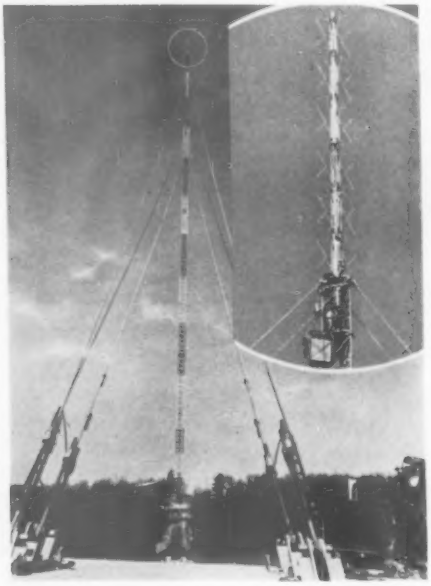
*Working weldor's description of the revolutionary GOLD STAR SR

LEFT: Monel alloy tubes are Tig welded to steel legs of offshore oil-drilling platform to stop salt water corrosion. Dupont Fabricators, Inc., Morgan City, La., build the giant structures. Weldor here is using torch manufactured by Linde Co., with argon as shielding gas. Outdoor use of Tig process is unusual, and performed only on windless days.

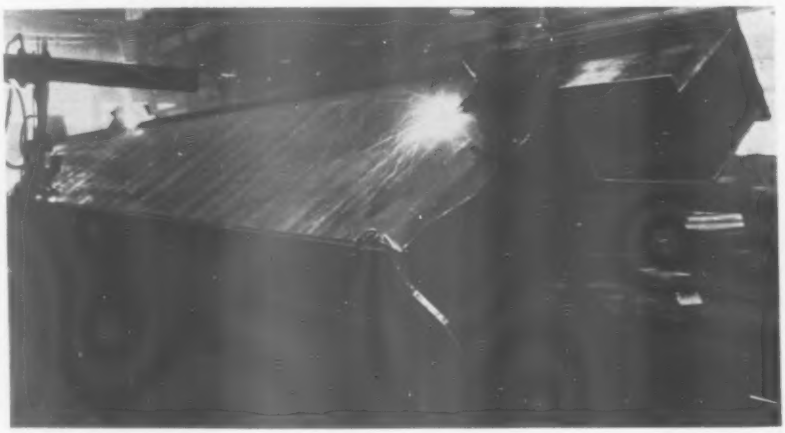
On the job...

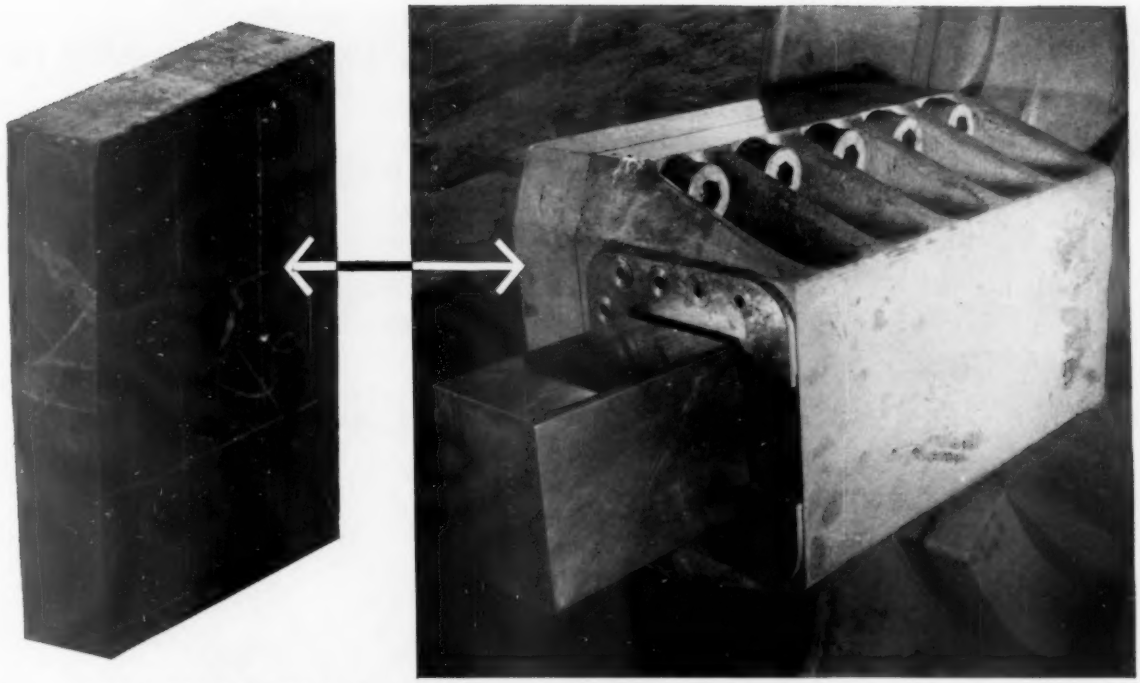
EASY does it . . . the apparent motto of maintenance weldors at Clark Equipment Co.'s Industrial Truck Div. Using one of their firm's battery-operated hand trucks, weldors bolted 450-amp welder to forks, and welded control panel to top of motor case. Five steel containers hold electrodes, and scrap angle irons form racks for hose and clamps.



IDECO-Dresser Co., Columbus, Ohio, sent one of its bravest weldors to the 1,100-ft level of new WBZ-TV transmitter tower in Needham Heights, Mass., to join 99-ft antenna section not otherwise supported by guy wires. Slung below weldor *(inset)* is a welding machine supplied by welders Supply Co., Cambridge, Mass., and manufactured by Hobart Bros. Co. Low-hydrogen electrodes were used.

RIGHT: Giant girder for hot metal ladle crane is fabricated with both manual and automatic submerged-arc welding by Morgan Engineering Co., Alliance, Ohio. Girder weighs almost 60 tons; total weight of crane (with electric equipment, but not ladle and hot metal) is approximately 920 tons. Crane, largest of its kind ever built, is one of three being constructed for eastern steel mill. It will hold 375 tons of hot metal.



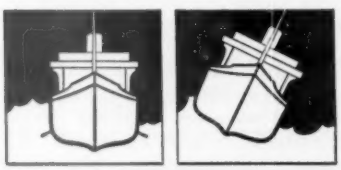


The face of this steel block wouldn't stand a chance against the sea's bite . . . against grinding metal-to-metal wear. But in the flap control . . .

A welded Monel overlay, deposited with "140" Monel electrode, gives the steel an extra-hard, corrosion-resisting rubbing surface. Newport News Shipbuilding and Dry Dock Co., Newport News, Va., fabricated and assembled the structural parts.

In Gyrofin® Ship Stabilizer:

Economical Monel overlay protects steel block from wear and corrosion



Twin underwater fins of Sperry's Gyrofin® Ship Stabilizer eliminate up to 90% of a ship's roll in heavy seas, help keep her steady and on course.

The hydraulic ram, shown above right, controls the flap at the trailing edge of the fins of the Gyrofin® Ship Stabilizer.

Notice its housing. Particularly the heavy face plate. This member has to be able to take hard wear. Its surface must remain true despite this abusive metal-to-metal rubbing . . . despite salt water attack.

An obvious job for Monel* nickel-copper alloy, but Newport News Shipbuilding engineers required the superior properties of a high alloy *only* on one surface.

So they made the block of steel, faced it with a welded overlay of Monel alloy . . . using "140" Monel* electrodes. At the critical wearing surface, the "140" Monel overlay provides hardness comparable to that of solid alloy . . . high resistance to corrosion and erosion, too.

"140" Monel electrode may make money-saving overlays practical for you, too. It produces strong, ductile, tightly-adhering deposits. It's easy handling. And its special low-carbon flux coating permits crackfree overlays directly on steel.

A new booklet . . . "Inco Welding Products" . . . describes the "140" series of electrodes and all other Inco Welding Products: dependable electrodes, wire, rods, and fluxes for joining the high-nickel alloys to themselves and other metals. Gives recommended applications . . . specifications . . . helpful data. For your copy, address a postcard to:

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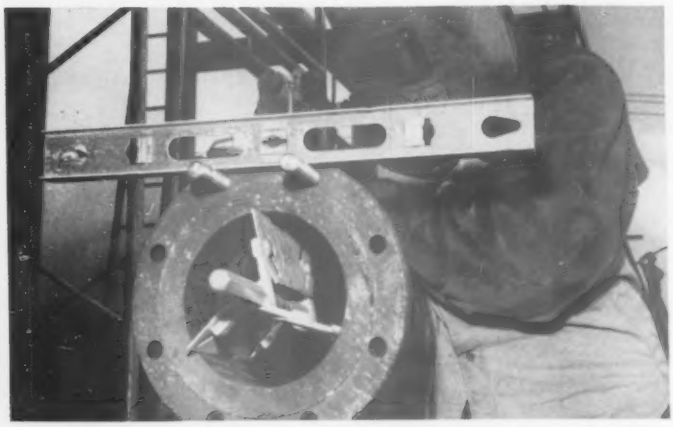
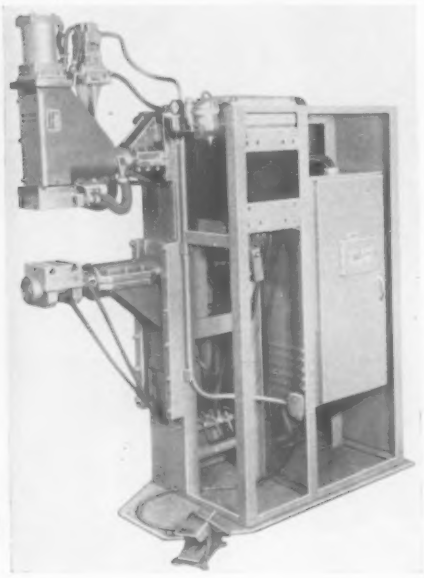
new products . . . . . USE CARD ON PAGE 115



ABOVE: One man can position weld neck flange on pipe with this 3-blade internal line-up clamp.



RIGHT: Compact spot and projection welder features adjustable arms; panels are removed to show controls.

Line-up clamp

NEW tool is for pipe fabrication when weld neck flanges or stub-ends are used. Line-up clamp is inserted into pipe, and flange or stub-end is placed on projecting end. Few turns of the mandrel bring blades into contact with pipe and fitting ID's. Three-blade design assures line-up of internal surfaces. Available for pipe sizes from 3 to 20 in. in 4 units: 3-4 in., 6-10 in., 12-16 in., and 12-20 in. Blades are interchangeable for 6-20 in. sizes. *Line-O-Tool Co.*

Circle No. 1

Drill press vise

DRILL press vise has solid base that can be turned on edge for drilling at 90-deg. angle. Vise is 2¾ in. high, with jaws 1¾ in. deep. Two models are made, one with screw action and one with rapid action. *Wilton Tool Mfg. Co., Inc.*

Circle No. 2

Oxygen pump

TWO-stage centrifugal pump for liquid oxygen is designed for use in servicing high-pressure customer stations and pumping applications requiring transfer capabilities up to 300 psi. Pump is extremely lightweight, requiring practically no cool down. It lends itself to intermediate on-off service, requires the lowest possible NPSH requirement, and is ideal for use in transport vehicles, states the manufacturer. Pump is made of 356T6 aluminum and weighs 8 lbs. "Model EMP-30-35" utilizes a 10-hp, 2-pole speed motor to deliver 35 GPM at 600-ft head rise. The pump will deliver 50 GPM at 500-ft head rise. *Cambridge Corp.*

Circle No. 3

Control valve

AIR control valves are poppet-type. These "Nopak-matic" valves are available for pressure to 150 psig, for 2-, 3- and 4-way operation with master (air), single or double solenoid pilot control. Pipe sizes are ¼-¾ in. *Galland-Henning Nopak Div.*

Circle No. 4

Pipe shop

MOBILE pipe shops include specially designed truck-drawn trailers that accommodate the 'Thred-O-Matic 22" pipe threader, the "E-Z" cutter for pipe and tubing (or the "Abr-A-Saw") and a generator. The trailer provides work bench for jobs in the field. *Collins Machinery Corp.*

Circle No. 5

Resistance welder

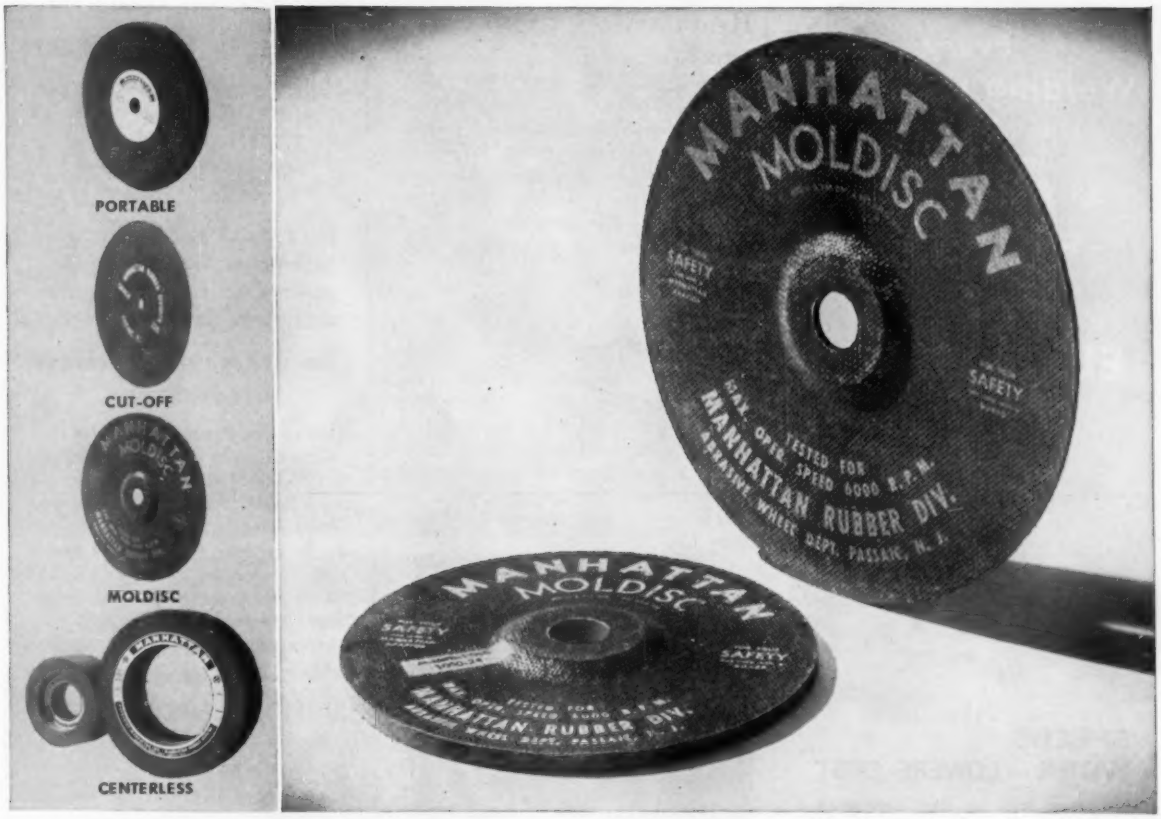
ARMS of new roller head press-type combination spot and projection welder can be installed left or right of center. Unit with right-hand mounted arms may be installed next to one with left-hand arms to bring electrodes within 9½ in. for sequence welding operations. Welder is about one ft smaller than conventional units. An arm can be extended to give up to 30-in. throat depth. Lower arm can be adjusted vertically 15 in. Standard head may be replaced with special adaptations in minutes. *Allied Welder Corp.*

Circle No. 6

Turning rolls

COMPACT new turning rolls can be used as portable rotators for field use or in shops with 110-volt alternating current. New "M-15 Portable Pipe Rotator" has one variable-speed powered roll and one idler roll. Wheels on both units are rubber-tired. Capacity load of one power and one idler unit is 1,500 lbs. Wheel centers are fixed, requiring no adjustment on pipe sizes from 2 to 24 in. Also available is a unit with adjusting spacing for work up to 8 ft in diameter. *Webb Corp.*

Circle No. 7



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Every turn of a Manhattan Moldisc exposes a fresh, sharp abrasive surface right down to the last usable part of the wheel. Tests prove Manhattan Moldiscs are the most economical portable grinding wheels you can use on right angle grinders. They cut freely, even on the toughest roughing and finishing jobs. This is because Manhattan Moldiscs are custom-made for your specific requirements in mild steels, stainless alloys, aluminum or copper. They're *safer* and *easier* to use because they're light in weight and reinforced with special super-strength synthetic fabric to prevent breakage on the job.

Ask a Manhattan abrasive wheel engineer about the wide range of types in Manhattan Moldiscs from harder, stiff bonds for fast roughing . . . to resilient bonds for fine finishing. Ask him, too, about Manhattan Portable Wheels, Cut-Off Wheels and Centerless Wheels. For *every* cutting or grinding operation there's a high speed, heavy duty Manhattan Abrasive Wheel to do the job *better, faster,* at *lower* cost . . . to give you "More Use per Dollar."

RMT40

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Heat treating

TWIN hearths for double production are provided in new "AGF 242" shaker furnace for heat treating. Parallel sealed hearths can also heat treat two different parts which require the same processing atmosphere at the same or different time cycles. Each hearth can process 800 lb of work per hour. *American Gas Furnace Co.*

Circle No. 8

Jigs, fixtures

REST buttons of alloy steel are available in two types and complete size range for jig and fixture applications. They can be used as cutter set-gage blocks and as locating parts. Ample grinding stock is left on shank for final fitting by user. *Jergens Tool Specialty Co.*

Circle No. 9

Water saver

WATER waste can be cut by using this coolant control, "Water Mizer ET-301P," states the manufacturer. The unit can be used with spot, seam, projection and flash welders. It controls water flow each time a weld is made and provides thermostat-monitored pilot flow when welding stops. Unit has 3 "Hi-Lo" monitor outlet ports and pilot monitor flow from each port can be of different volume. *Van Vooren Products.*

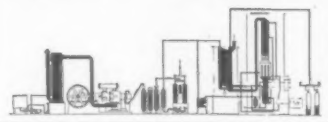
Circle No. 10

Solder-flux

VERSATILE compounds are finely-powdered pure solder, suspended in active flux. The "Flux-'N-Solder" speeds sweat soldering, assembly soldering and tinning or solder coating. Just paint on, heat and joint is soldered. Any type of heat such as flame, induction or hot plate can be used. Flux and solder are applied in one motion by dipping or brushing. *Johnson Mfg. Co., Inc.*

Circle No. 11

Make Oxygen



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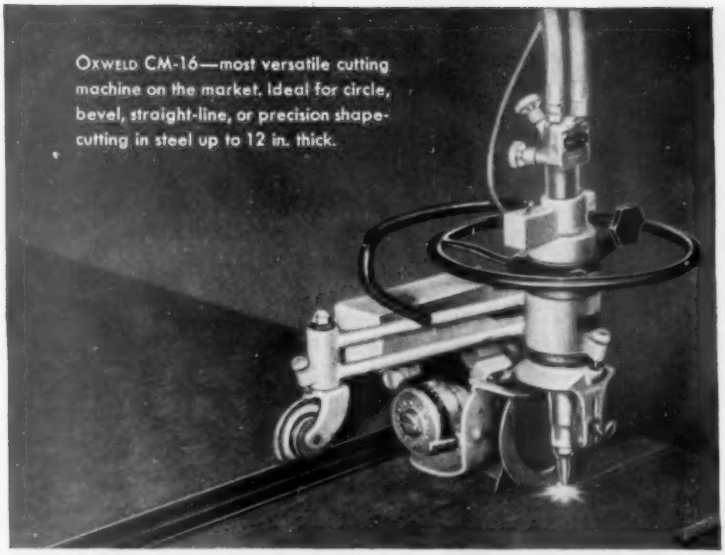
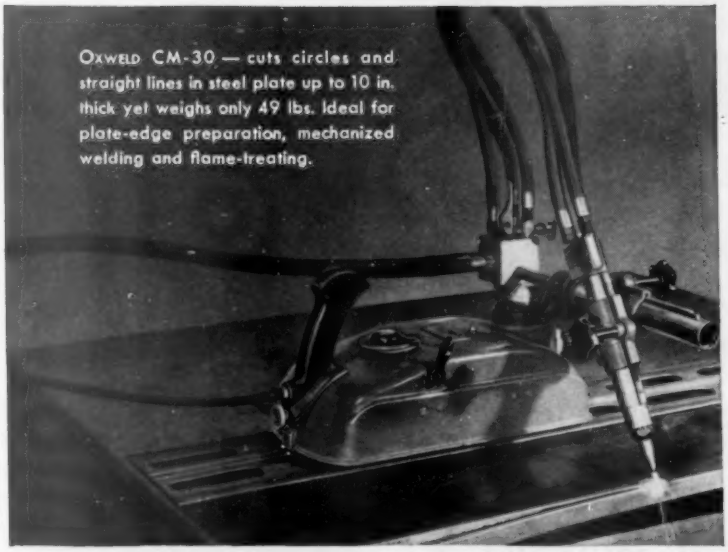
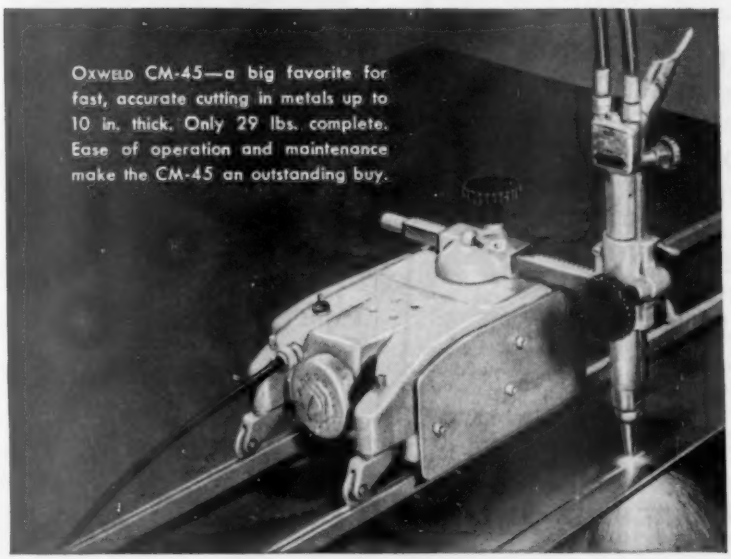


OXWELD CM-16—most versatile cutting machine on the market. Ideal for circle, bevel, straight-line, or precision shape-cutting in steel up to 12 in. thick.



OXWELD CM-30 — cuts circles and straight lines in steel plate up to 10 in. thick yet weighs only 49 lbs. Ideal for plate-edge preparation, mechanized welding and flame-treating.



OXWELD CM-45—a big favorite for fast, accurate cutting in metals up to 10 in. thick. Only 29 lbs. complete. Ease of operation and maintenance make the CM-45 an outstanding buy.

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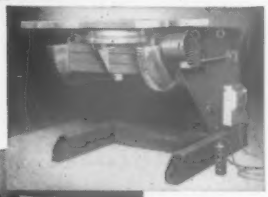

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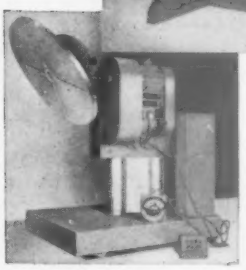
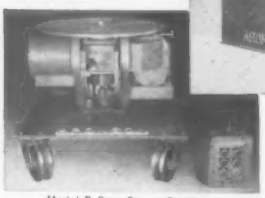


Heavy Duty Gear Driven Positioners, with Magnetic Braking, Mercury Grounding, and Optional Speeds. Capacities to 120,000 lbs.



Heavy Duty Floor Turntables with precision speed control and Magnetic Braking, used for welding, burning, X-raying, etc. Capacities to 120,000 lbs., various heights and speeds.

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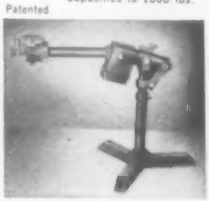
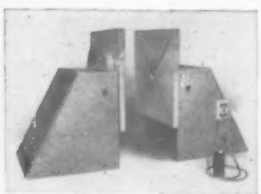


Aronson Universal Balance Positioners (T. M. Reg.) position your weldments effectively, instantly for downhand welding. Capacities to 2000 lbs.



Rugged Head and Tail Stock for positioning bulky weldments between centers. Table Backup for Zero Deflection, Magnetic Braking. Capacities to 160,000 lbs.

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Cover goggles

SPECIFICALLY designed for those who need a smaller size all-purpose cover goggle, "Model 440M" has wide-angle lens which fits over most prescription glasses. Frame comes in clear, green or opaque black vinyl. Lens available in either methacrylate for heavy-impact protection or acetate for average protection. Methacrylate comes in clear, yellow, cobalt blue and light, medium or dark green. Acetate comes in clear or green. *Watchemoket Optical Co., Inc.*
Circle No. 14

Metal abrasive

RUBBER-bonded abrasive is for removal of heat marks from metals. Available in powder form, it is nonferrous and suitable for use on stainless steel and mild steel. "Brightboy" compound is rubbed on heat mark with wet cloth to remove mark. Abrasives are blend of aluminum oxide and silicon carbide grains. Sample can for trial from manufacturer. *Weldon Roberts Rubber Co.*
Circle No. 15

Helmet liner

WINTER liner is designed for safety hard hats. The "WL'57" winter head-warmer hood fits snugly around the face, covers exposed portions of the head, and ties under the chin. *United Mfg. Facilities, Inc.*
Circle No. 16

Pipe cutter

PORTABLE "22" is a pipe, conduit, bolt cutter and threader. The "Thread-O-Matic" has automatic, power-operated double chuck. It can thread pipe from ⅛-2 in. and bolts from ¼-1½ in. Unit includes three duotype scroll die heads with separate reamer assembly. *Collins Machinery Corp.*
Circle No. 17

Plant, Research Laboratories and World Headquarters

BETTER ORIGINAL FASTER
Low Temperature EUTECTIC WELDING ALLOYS
STRONGER WELDS

EUTECTIC Welding News

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"EUTECTIC" WELDING HEADLINES • TIME-MONEY-MACHINERY SAVERS

EUTEC-CHAMFERTRODE REMOVES "FATIGUED" METAL FASTER

By using Eutec-ChamferTrode and Eutec-CutTrode, an Oklahoma hydro-electric plant avoided time-consuming grinding away of "fatigued metal" and accomplished the quick repair of a turbine bucket with great savings in "downtime" and labor.

The bucket, part of a 57-ton turbine, was in danger of cracking because of fatigued metal formation. The bucket's inaccessibility prevented the use of grinding equipment to remove the fatigued metal before welding on stainless steel plates. Eutectic's District Engineer recommended Eutec-ChamferTrode and Eutec-CutTrode, high speed electrodes for gouging, chamfering, and piercing all metals, without the use of oxygen or extensive equipment.

(Fig. A)

First, the fatigued area was marked off and an outline cut with Eutec-CutTrode. Weldors then gouged out the defective metal with Eutec-ChamferTrode (Fig. A). Gouging was accomplished far more quickly with ChamferTrode than would have been possible with any mechanical grinding equipment. ChamferTrode's special exothermic coating concentrates the force of the arc right at the point of application, producing a highly efficient metal removing tool.

(Fig. B)

Stainless steel plates were then tacked on with EutecTrode 680 AC-DC, an all purpose, high tensile, corrosion resistant electrode for very high alloy and carbon steels. Repair was completed by welding again with EutecTrode 680 AC-DC, which produced a smooth, porosity free weld of perfect density (Fig. B). The weld was deposited at the highest possible speed. Welding was done at lowest possible amperage and no warping occurred. Finished weld has exhibited high strength and wear. *(A-30)*

WELDING MACHINE BASE WITHOUT DISMANTLING SAVES $3200

Use of Eutec-ChamferTrode and Eutectic "Low Temperature Welding Alloys" to repair the heavy base casting on a planer without dismantling it from the planer saved an Idaho lumber company $3200 and four months "downtime." To replace the base casting, which cost $1200, the entire planer would have to be shipped to its East Coast manufacturer. This would have cost $2000 in railroad fares and kept the planer out of production for four months.

Eutec-ChamferTrode was used to give a right angle chamfer to all broken edges on the casting. The weldor then applied a dense, smooth weld of EutecTrode 27, a high strength, ferrous electrode for all cast iron repairs where machinability is not desired. The base casting was re-welded with Xyron 2-24, which permits "cold" cast iron welding from all positions without dismantling heavy sections. Xyron 2-24's "Frigid Arc" coating produced a dense, machinable weld, free from cracks and stress formations. Weldors have found that Xyron 2-24 gives very close color match and permits great ease of application. *(A-31)*

EUTECROD 16FC LOWERS FINISHING COSTS

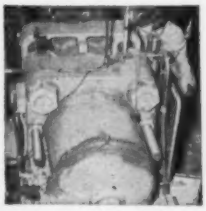
Warping and uneven welds caused by conventional high heat welding materials led a manufacturer of calculating machine carriage shells to try EutecRod 16FC, a

highest strength, "brazing type" alloy for joining steel and other metals. Precision standards for the carriage shells made warped parts unacceptable. Further finishing of uneven welds was an added cost to the manufacturer.

Use of EutecRod 16FC has resulted in lowered finishing costs and stronger welds. Great capillarity of EutecRod 16FC makes it ideal for thin forming operation required in welding carriage shells. EutecRod16FC produces a smooth, porosity free weld requiring no further extensive finishing. It is applied at the lowest possible temperature without fusion of the base metal. No warping occurs. Ultimate tensile strength is up to 100,000 psi. *(A-32)*

EUTECTRODE 680 AC-DC WITHSTANDS 1500 PSI

EutecTrode 680 AC-DC has again demonstrated its high tensile strength in repairing the hydraulic compression chamber of an injection molding machine. An eastern manufacturer had tried unsuccessfully to repair the compression chamber, made of cast steel, with conventional high heat welding materials. These welds all cracked under the stress of 1500 psi pressure in the compression chamber.



Before replacing the compression chamber, at a cost of $4200, the manufacturer called in a Eutectic District Engineer. He suggested EutecTrode 680 AC-DC, all purpose, high tensile electrode for very high alloy and carbon steels. Welds of EutecTrode 680 AC-DC were deposited at high speed and at lowest possible amperage settings. The manufacturer discovered that EutecTrode 680 AC-DC gave a smoother, denser weld, free from porosities and undercutting. In operation, the weld has combined high tensile strength with sufficient elongation to absorb compression chamber stress without cracking. The ultimate tensile strength of EutecTrode 680 AC-DC is 120,000 psi. *(A-33)*

CAST IRON WELD SAVES $6,000, FOUR MONTHS "DOWNTIME"

By using EutecRod 1804 to repair a 50 HP motor which had eight cracked fins at the end of its armature, a New England aircraft plant saved $6000. This was the cost for removing the motor from the plant, repairing it, and re-installing it.

Company officials consulted Eutectic's District Engineer. He suggested repair with EutecRod 1804, a copper base, silver bearing, thin flowing alloy that produces high strength joints on close fitting operations. Using 15 lbs of EutecRod 1804, a weldor repaired the armature fins in less than six hours. Welds have shown excellent wear and conductivity. EutecRod 1804 does not require fusion of the base metal; its ultimate tensile strength is up to 50,000 psi. *(A-34)*

Eutectic Welding Alloys Corporation
40-40 172nd Street, Flushing 58, N.Y.

Gentlemen:

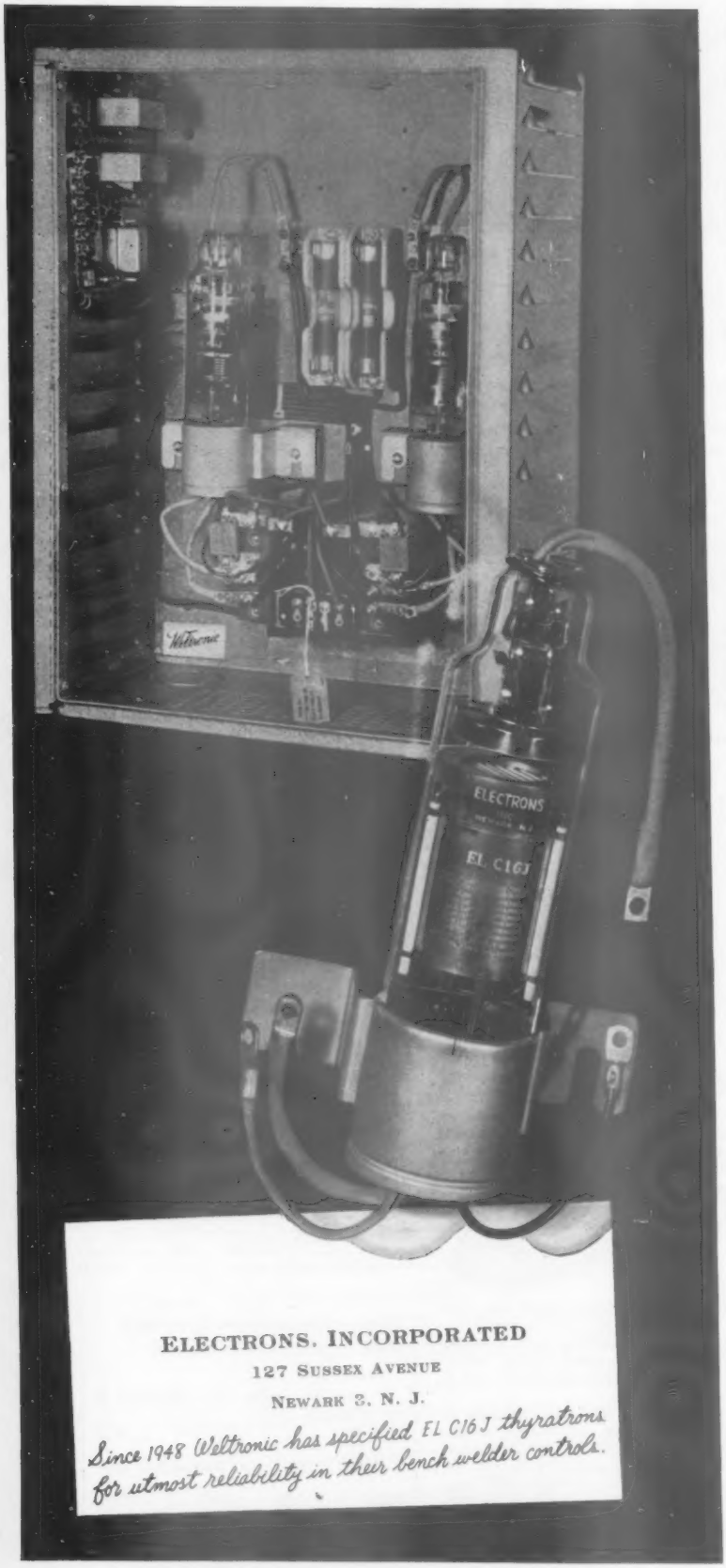
I would like further free information on the following:

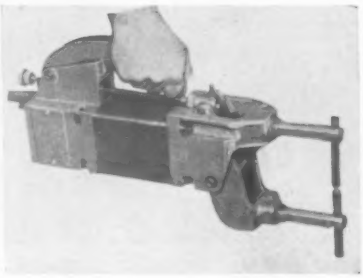
☐ A-30 ☐ A-31 ☐ A-32
☐ A-33 ☐ A-34
☐ **Free 170 page pocket Welding Data Book.**

Name_____

Address_____

City_____ State_____


ELECTRONS
EL C16J
ELECTRONS, INCORPORATED
127 SUSSEX AVENUE
NEWARK 3, N. J.
Since 1948 Weltronic has specified EL C16J thyratrons for utmost reliability in their bench welder controls.



Spot welder

BUILT-IN "trip switch" is featured in the new "P-166A" spot welder. It has high welding current, easy one-hand operation, and adjustable spring pressure. *Aro Spot Welder Div., Guthery Machine Tool Corp.*

Circle No. 18

Brazing alloy

"BRAZE-Clad N" can be blanked, stamped, rolled, bent or shaped as if the brazing alloy were not present, its manufacturer reports. It is supplied as a predetermined thickness of silver-brazing alloy on one or both sides of a pure nickel base. Since the brazing alloy is metallurgically bonded to the base, it cannot crack or peel off. This new material is particularly useful for high-temperature applications. *American Silver Co., Inc.*

Circle No. 19

Power pack

POWER pack attachment is for a 500-amp combination a-c/d-c "Idealarc" welder, designed to permit use of welder as power source for the manual "Lincolnweld ML-2" semiautomatic submerged-arc welder. Combination of the two welders and a power pack makes package capable of manual "Lincolnweld ML-2" semiautomerged-arc welding with d-c. Power pack mounts directly on "Idealarc." *The Lincoln Electric Co.*

Circle No. 20

Rigid PVC pipe

RIGID (unplasticized) polyvinyl chloride pipe is now available in pipe sizes from ¼-6 in. PVC pipe is useful in many applications, particularly where corrosion resistance is a factor. Available as electrical tubing (EPT) it can be used for protection of electrical wiring. Both pipe and tubing is easily worked and assembled—can be sawed, threaded, *welded*, machined, formed. *Easton Plastic Products Co., Inc.*

Circle No. 21

Please and

PROTECT EVERY WORKER*

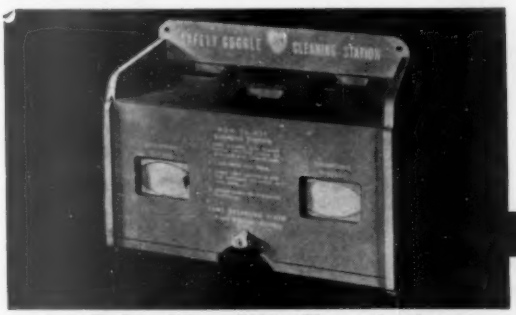
with Comfortable, Engineered AO F5100 Safety Glasses!

(*Who needs impact protection)

Here are our popular metal frame Ultrascopic Safety Glasses with many new features. In comfort, safety and styling (which makes the device willingly worn) there is no better eye protection. Specify the AO F5100 — reduce accident costs!

NEW FEATURES INCLUDE:

- Complete range of eye sizes (42, 44, 46, 48)
- Complete range of bridge sizes (18, 20, 22, 24, 26)
- 2 temple styles in all lengths. Comfort cables for both side shield and non side shield models, spatula temples for latter
- Screen, clear acetate and green acetate side shields
- Clear and Calobar 6 curve lenses



To be safe keep Safety Glasses clean!

AO 750 LENS CLEANING CABINET

Stationed at strategic plant locations, these cabinets give workers everything needed to keep safety glasses at peak visual efficiency. Cabinet is a small compact unit, providing all necessary cleansing and anti-fog materials. Made of selected hardwood, safety green lacquered finish. 12″ long, 9″ high, 6″ deep. Contains 6 oz. bottle 750B and sprayer.

750S: Bottle can be used with AO #750F Fluid or AO 350AF Super-Clear anti-fog-cleaner fluid.

750T Cleansing Tissue: 2 boxes each with 120 sheets supplied. 2 openings in front of cabinet permit easy detachment of single sheets (no waste).

Tissue Disposal: 2 openings at top of cabinet provide for disposal, keep area neat and tidy.

111 Anti-Fog: 1 oz. jar supplied with cabinet. AO 350AF Super-Clear available on special order.

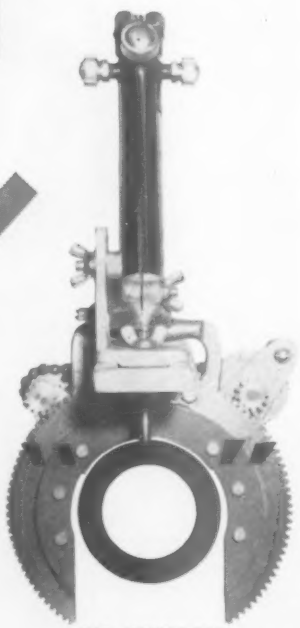
American Optical Sweatbands increase worker comfort and efficiency, keep sweat out of eyes — prevent accidents — for pennies! Check your needs.

Always Insist on AO Trademarked Safety Products. Your nearest American Optical Safety Products Representative can supply you.

SOUTHBRIDGE, MASSACHUSETTS
BRANCHES IN PRINCIPAL CITIES

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

model "O" for small diameter pipe cutting and beveling



PAT. APPLIED FOR

Welding of small diameter pipe (1½" to 4") becomes the easiest, quickest, most accurate — **and most economical** — means of joining such pipe when every cut and bevel is square and accurate.

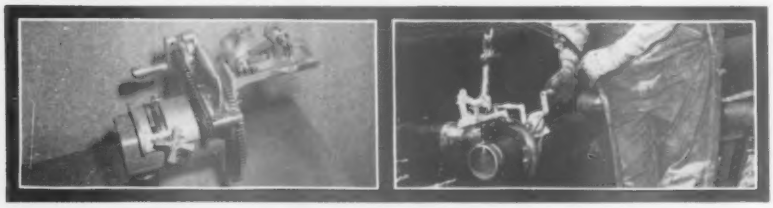
The never-failing precision-action of H & M's exclusive Model "O" has been field-tested and proved on hundreds of welding jobs — **even** when operated **by apprentice welders!** A perfect cut and bevel can be made on 2" pipe, for instance, in less than 30 seconds actual cutting time — **by an inexperienced operator.**

The H & M Model "O" is built on the same split-gear horseshoe principle as the larger H & M Machines (for 4" to 36" pipe). Weighing only 7½ lbs., it may be placed on continuous pieces of pipe — moved from one pipe to another — changed from one size to another — **all in a matter of seconds!**

If you are manually welding your small-diameter pipe — or if you aren't welding at all — an H & M Model "O" Pipe Cutting and Beveling Machine is your primary step towards greater speed, accuracy, precision and profits in joining small diameter piping.

The Model "O" — like all H & M Machines — can easily and quickly be motorized for automatic operation.

Write today for illustrated bulletin.



H&M PIPE BEVELING MACHINE COMPANY

TULSA, OKLAHOMA

Trademark Registered

311 E. Third St. Diamond 3-0241

Aluminum torch

WELDING torch is made of aluminum. The handle of the "Saffire" is built up from two tubular ribbed aluminum extrusions—the outer casing is drawn over inner member through a die to clamp both parts together. This makes the equivalent of a section with holes (for carrying oxygen and acetylene) throughout torch length. *British Oxygen Engineering Ltd.*

Circle No. 22

Face shield

FIBER GLASS spark guard is claimed a "first" for this new face shield. The manufacturer states use of this material ends moisture-and-heat absorbing characteristics that distort or destroy usual face shields.

Besides shape-retaining qualities, new "328" face shield is said to afford larger window area—coverage around face is 1 in., with choice of either 8 or 1-in. window height. Ratchet adjustment provides comfortable exact fit. Windows, available in green or clear shades, can also be supplied with aluminum binding. *Sellstrom Mfg. Co.*

Circle No. 23

Cutting torch

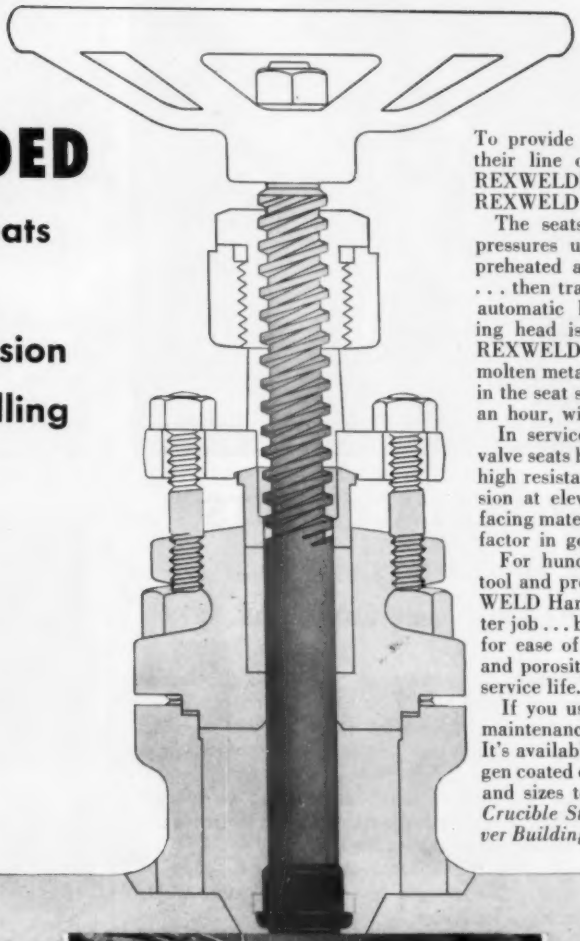
NEW light-duty oxyacetylene cutting attachment is for the "400" lightweight welding torch. The "1490" attachment weighs 13 oz and is 9½ in. long. Cutting range is to 1-in. thick steel.

Firm gas-tight seal is assured, states the manufacturer, with tapered gas sealing rings. A diaphragm-type cutting oxygen valve eliminates need for valve packing and prevents gas leakage. There is a removable mixer for easy cleaning. *Air Reduction Sales Co.*

Circle No. 24

REXWELDED

steam valve seats resist erosion, corrosion, abrasion ... are non-galling



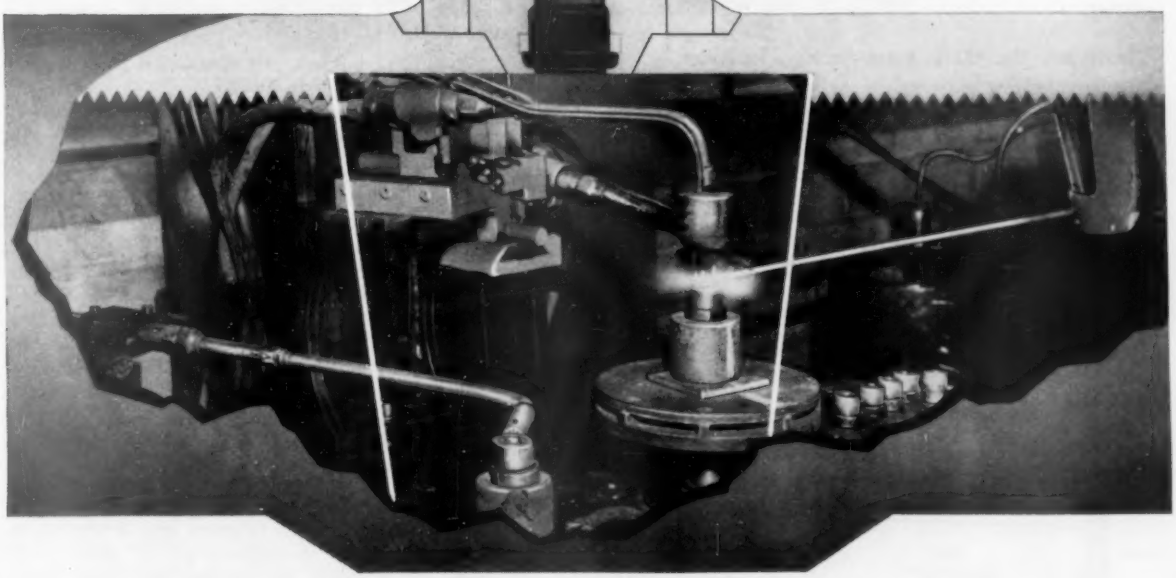
To provide long, trouble-free service life for their line of gate valves, the manufacturer REXWELDED the valve seats with Crucible REXWELD A Hard Surfacing Rods.

The seats for these valves, which handle pressures up to 800 psi at 750°F, are first preheated as shown in left portion of photo . . . then transferred to welding table of semi-automatic hardfacing machine. After welding head is lowered hydraulically, a rod of REXWELD A is fed into the flame and the molten metal is deposited in the circular recess in the seat surface. Machine produces 70 seats an hour, with a rejection rate of only 1%.

In service these REXWELD hard-surfaced valve seats have demonstrated an exceptionally high resistance to erosion, corrosion and abrasion at elevated temperatures, and the hard-facing material does not gall—a very important factor in good valve operation.

For hundreds of other applications where tool and product life must be increased, REX-WELD Hard Surfacing Rods have done a better job . . . because they are especially designed for ease of application and to produce crack and porosity free surfaces that give maximum service life.

If you use hard surfacing in production or maintenance, be sure you order REXWELD. It's available in both bare rods and low hydrogen coated electrodes—in many different grades and sizes to meet your specific requirements. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*



CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

SAVE COSTLY REPLACEMENTS

...get fast, strong repairs with Bridgeport No. 192 Low-Fuming Bronze Rod

This scale was a vital link in a plant's materials weighing section. Operations slowed down when its cast iron frame was smashed. Braze welding with Bridgeport No.192 Low-Fuming Bronze Rod had it back on the job good as new in a matter of hours...another example of time and money saved through repair with braze welding.

Bridgeport No. 192 is a low-fuming manganese-type, all-purpose rod recommended for both repair and production welding. It tins readily and the base metal needs relatively little local preheating, thus avoiding brittleness. Many repairs are possible without disassembling or moving heavy equipment. And welds are frequently stronger than the base metal.

Write today for your free copy of Bridgeport's new booklet, "Bronze Welding Alloys."

HANDY GUIDE TO BRIDGEPORT WELDING ALLOYS

ALLOY	Welding Method	Approx. Melting Point °F
192 Low Fuming Manganese	GAS	1600
191 Manganese Bronze (Navy)	GAS	1600
196 Bridgeport Bronze	GAS	1600
606 Silicon Bronze (3% Si)	GAS or ARC	1865
548 Nickel Silver	GAS	1675

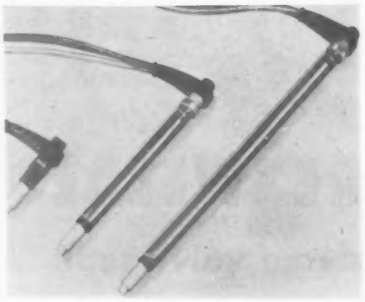
Bridgeport BRASS CO.

BRIDGEPORT BRASS

Offices in Principal Cities • Conveniently Located Warehouses

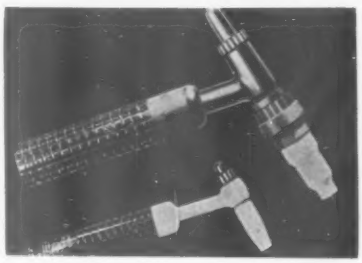
Bridgeport Brass Company, Bridgeport 2, Conn. • In Canada: Noranda Copper and Brass Ltd., Montreal

BRASS • BRONZE • COPPER • SHEET • ROD • WIRE • TUBE • ALUMINUM EXTRUSIONS AND FORGINGS



Torch holders

LINE of manual and machine holders are for Tig welding. It is composed of lightweight air-cooled and water-cooled manual holders, heavy-duty water-cooled manual holder and three new water-cooled machine holders for



automatic and semi-automatic Tig welding. Manual holders are "H10-A," "H10-B" and "H20-A;" "H50-A" is heavy-duty type; "M50-A," "M50-B," "M50-C" are machine holders. *Air Reduction Sales Co.*

Circle No. 25

Hi-temp insulation

HIGH-temperature insulation is said to have good solvent resistance. The new "T-9278" insulation material is made of flexible straight-weave glass fabric, coated with modified-silicone resin.

The insulation weighs ½ lb. per sq. yd., is 0.007 in. thick and has tensile strength of 164 lb. per in. width. *Westinghouse Electric Corp.*

Circle No. 26

Air, gas strainer

STRAINER is designed for fine straining of air or gases, and, according to the manufacturer, is particularly suited for keeping regulators clean. Series "137" strainer has a removable strainer element of porous bronze which strains out particles 0.004 in. and larger (90 microns). It is available in pipe sizes ¼, ⅜ and ½ in. suitable for pressures to 500 psi. *Watts Regulator Co.*

Circle No. 27

Great, New Custom Silver "W" Welder, by Westinghouse

HIGH FREQUENCY! A-C or D-C!
ALL BY REMOTE CONTROL! — FAST!

This Custom Silver "W" *now delivers*—in *one* machine—*all eleven* aids to better, faster, easier welding, that recently were asked for by 2744 welding operators themselves!

You get straight AC welding at its finest. AC welding with high frequency automatically maintained — *ideal* for gas shielding! Or, high frequency utilized only at arc start. Moreover, your high frequency is varied in intensity, as you need it! All with *instantaneous* remote control!

You get DC welding with *full 375 amperes!*—assuring use of *bigger* electrodes! Still you have *immediate, constant* control of high frequency, as desired, for DC gas-shielded welding on the *lightest* work! And all by simple, exacting, remote control that *eliminates craters!*

Then, the Custom Silver "W" also gives you quick polarity selection—built-in, automatic water and gas controls (that clear the line both before and after use)—even an automatic timer for spot welding!

Yet above all this, the Custom Silver "W" incorporates the *easiest settings ever*, with the widest current range overlap in the industry! *Positive* instantaneous arc start, from the Westinghouse pre-energized reactor! And *utmost arc stability known!*—from the Westinghouse, exclusive smoothing reactor—and now from Westinghouse SILICON Rectifiers!

SILICON Rectifier Diodes 98% Efficient!

Hermetically sealed! Ageless! Unparalleled capacity! Give *unprecedented* arc stability, *absolute* depth of penetration desired, *lowest cost* welding now known! *Predicted soon to be copied throughout the entire industry!* J-22087

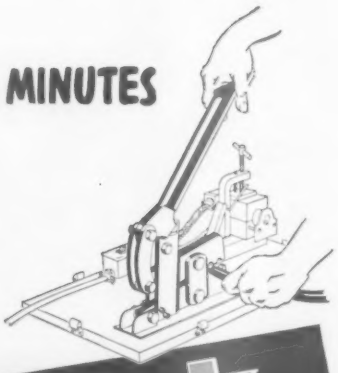
Accept complete information, help, from your local Westinghouse Welding Distributor!

YOU CAN BE SURE... IF IT'S Westinghouse

Vulcanized, permanent cable splices WITHOUT POWER LOSS

IN 5 MINUTES

IN YOUR OWN PLANT OR IN THE FIELD.



cam-lok

New Portable Kit . . . includes crimping press, cable cutter and vulcanizing mold.

New CAM-LOK portable Cable Splicing Kit produces vulcanized, neoprene insulated cable splices anywhere in just 5 minutes . . . makes them waterproof, shockproof.

Simply strip back insulation on cables . . . insert bare ends in copper tube supplied . . . crimp . . . place inner sleeve over crimp . . . vulcanize outer sleeve to cable jackets. No tools or experience needed . . . no production delays.

- Insulating sleeves are vulcanized to cable . . . can't pull away . . . prevents moisture from entering and damaging cable.
- Conductivity of splice is as good as the cable itself. Cables are crimped under great pressure into a pure copper crimping tube.
- Completed splice is tapered and only slightly larger than cable, so cable won't be caught on obstructions when dragged.
- Economical . . . because of low cost of components . . . allows you to splice as little as two, 2′ sections together, which might otherwise be wasted.
- Splice is flexible, because inner sleeve eliminates voids or weak spots in the insulation.
- Finished insulation of splice will withstand 2,500 volts without any leakage.

Bulletin No. 243 contains full information on this new Kit and Cable Splice. Write today for your copy.

CAM-LOK Division
Empire Products, Inc.
P. O. Box N-98, Cincinnati 36, Ohio

Motor brushes

SPECIAL graphitic brushes meet tough commutation demands, states the manufacturer. The "D" series are electrographitic lamp black brushes for d-c motors and generators. Recommended for general service on most d-c generators and synchronous converters. *Ohio Carbon Co.*

Circle No. 28

Finishing

TWO new sanders of orbital and belt designs feature fastcutting action for fine finishing of metal, plastic. "H36" orbital sander has pad size of 7 1/16 by 3⅝ in. and makes 4,500 orbits per minute. "H31" belt sander has power and ventilating systems; belt size is 3 by 24 in. Idle speed is 1,600 sanding feet per minute. *Stanley Electric Tools.*

Circle No. 29

RW welder

FULLY automatic resistance welder joins stranded copper leadwire to magnesium-encased batteries at 3,600 per hour. Both parts are automatically fed into the wire welder, the wire from a spool and the batteries from a loading chute. The wire is tin-coated and 0.024 in. diameter. Magnesium case is 0.040 in. thick. Tooling on this specialized welder permits welding two battery sizes. *The Taylor-Winfield Corp.*

Circle No. 30

Cleaner

CLOGGED tips on acetylene cutting torches can be cleaned with "Easy Tip" cleaner. Long enough (2¾ in.) to go through the cutting tip, cleaners are soldered onto a metal top which is clamped into a chuck for special drilling jobs. Set of twelve includes drill sizes 48, 50, 52, 59, 61, 63, 64, 66, 68, 70, 73 and 75 and is priced at $4.80. *Easy Tip.*

Circle No. 31

No underbead cracking even in "difficult" steels!

...with P&H Low-Hydrogen electrodes

And what a money-saver that can be — you cut out costly rewelds — get perfect jobs the first time on high carbon, alloy, high sulfur, free machining, and cold rolled steels.

What's more, with P&H Low-Hydrogen electrodes, you get better impact properties, greater ductility, and sounder welds. And, because these electrodes have a mild steel core, they cost much less than the high-alloy types otherwise required.

Get complete data. Ask for Bulletin R-29, "P&H Smootharc Welding Electrodes." Write Dept. 317B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

HARNISCHFEGER

P&H WELDERS • ELECTRODES • POSITIONERS
MILWAUKEE 46, WISCONSIN

PROOF of how to get dependable results welding by submerged arc

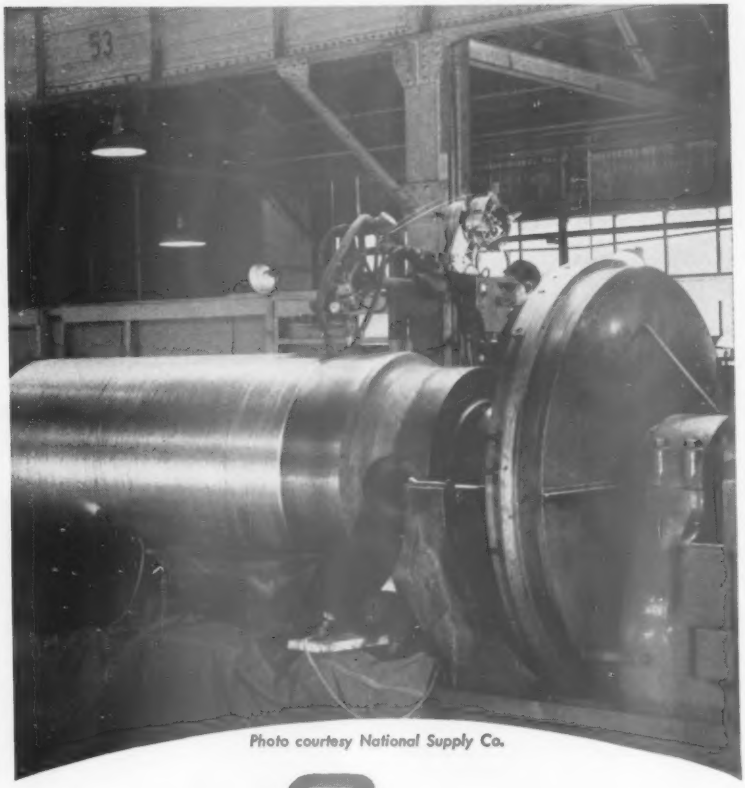
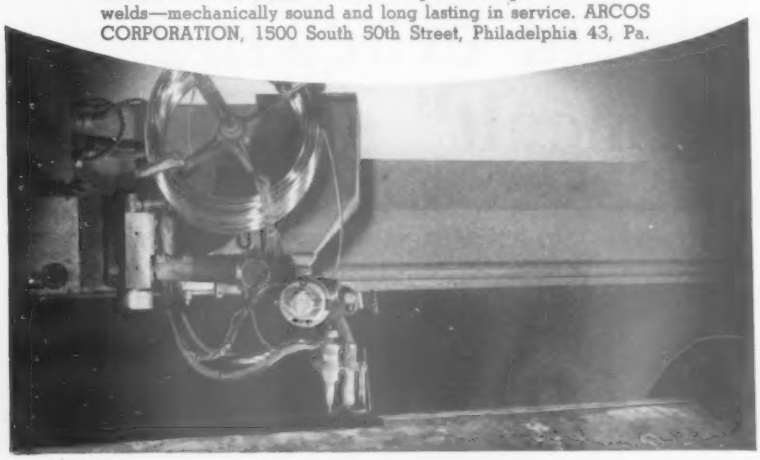


Photo courtesy National Supply Co.

WELD WITH ARCOS

CHROMAR Stainless COILED WIRE

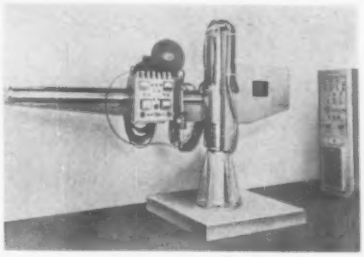
Shown above is a 72,000 lb. Extrusion Ram being overlaid by submerged arc with type 316 stainless weld metal. At the conclusion of the job the entire extensive welded surface was reported sound and crack-free—the same results you can expect with Arcos Chromar Wire on your own jobs. Arcos control of the composition of its Chromar *welding quality* spooled wire assures a transfer of all the elements needed to produce top notch stainless welds—mechanically sound and long lasting in service. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



Salt tablets

CONVENIENCE in use is aim of new throw-away dispensers for "Pep-up" impregnated and enteric salt tablets. The dispensers are colorful high-impact plastic. They are available in 500 and 100 tablet sizes. Dispensers, for all-weather use, inside or out, can be mounted to post, wall, water-keg, vehicle, etc. *United States Safety Service Co.*

Circle No. 32



Manipulator

WELDING head manipulator and control console are for longitudinal and circumferential welding. Manipulator is especially designed for welding aircraft jet engine components and similar intricate parts.

Both Tig (tungsten inert-gas) and Mig (metal inert-gas) automatic heads may be mounted on the manipulator. Electrical console provides controls for complete programming of welding. *Air Reduction Sales Co.*

Circle No. 33

Power junction

LIQUID-cooled germanium junction is for larger power-rectifier equipment. It is rated at 670 amp, 20-66 volts. For example, six of these junctions connected in a three-phase bridge circuit will deliver 4,350 amp d-c. They are utilized in heavy-power equipment in manufacture of oxygen gas, hydrogen gas, in aluminum reduction, anodizing, electro-plating, elecro-tinning. *International Rectifier Corp.*

Circle No. 34

Gas indicator

SUPERSENSITIVE indicator can measure as little as two parts per million of oxygen in hydrogen or in inert gases, despite presence of up to 3% carbon monoxide. Indicator can be used for quality control in production of nitrogen, helium and other inert gases. Model "SSS Deoxo" indicator is claimed ideal for those engaged in annealing, heat treating and for checking gas supplies for oxygen. *Baker & Co., Inc.*

Circle No. 35

Nitrogen generator

NITROGEN generator has wide controlled hydrogen-content range. The "Nitroneal" generator can produce oxygen-free nitrogen from ammonia in user's own plant. It is said to be inexpensive and easy to use. It draws nitrogen from air and ammonia rather than from only ammonia.

Model "GNLX" is fully automatic, has platinum catalyst, and removable insulator. Generators range in size from 50 standard cu ft per hour to 10,000 scfh. Only connections needed are 110-volt electrical receptacle, drain, single lines for water, air and ammonia. *Baker & Co., Inc.*

Circle No. 36

Aftercooler

WATERLESS aftercooler is for removing oil and water from compressed air lines. Unit consists of four air filters, connected in series and mounted to occupy only 18-in. sq floor space. The "Airlenco" filter is a 36-in. cylinder, 6-in. in diameter, mounted on smaller cylinder with perforated bottom and filled with fiberglass. Filters in series act as condensers. *Airlenco, Inc.*

Circle No. 37

Welding sheet

RIGID sheet "Quexon" is made of unplasticized and unmodified polyvinyl chloride. Rigid sheet is for fabricating corrosion-proof structures or machining chemically-resistant parts. It is easily machined, heat formed and *welded*. Can be formed into tanks, fume hoods, ducts, stacks, dampers, etc. *Quelcor, Inc.*

Circle No. 38

Electrode

"CHAMPION 16-8-2" electrode is for welding stainless types 316 and 347, used in high-pressure, high-temperature piping systems. Weld deposit has extremely high hot ductility, insuring freedom from cracking. Manufacturer is also introducing a new, two-color welding electrode carton. *Champion Rivet Co.*

Circle No. 39

Safety switch

LINE of safety switches includes type "LD" for light duty, type "ND" for normal duty and commercial work, type "HD" for heavy-duty use. Wide range of ratings are available in general purpose or raintight enclosures. *Square D Co.*

Circle No. 40

HOW TO GET WELDED SECURITY ON THE MOST CRITICAL JOBS

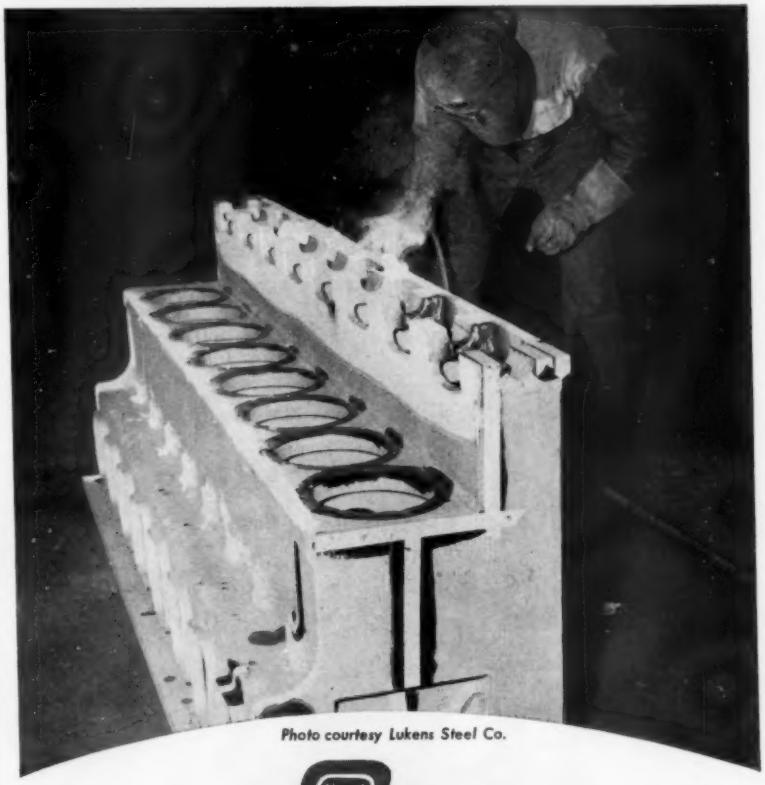
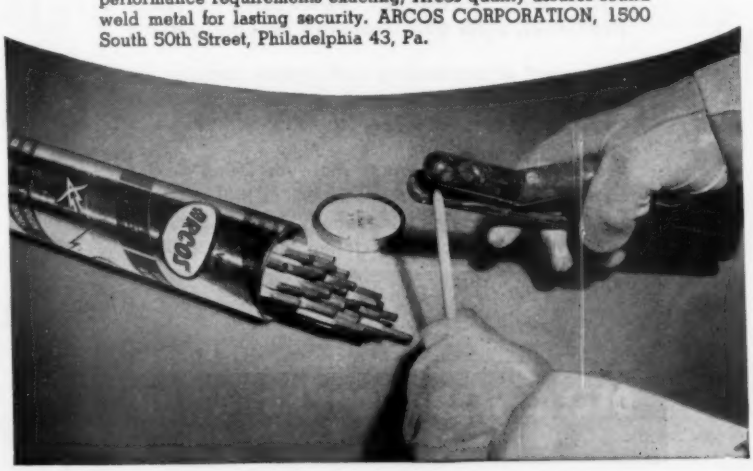


Photo courtesy Lukens Steel Co.

WELD WITH ARCOS

STAINLESS ELECTRODES

This Diesel engine housing—for use on a mine sweeper—is a new application for welded *stainless*. 18-8 stainless was selected for its non-magnetic properties. The unit, and many others, were completely welded with Arcos E308HC-15 low magnetic permeability coated electrodes. Why Arcos? For a reason you'll want to keep in mind: When base metal properties are critical . . . and performance requirements exacting, Arcos quality assures sound weld metal for lasting security. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



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DELTA
WELDER CORP.
MACHINES AND EQUIPMENT

High production resistance welding equipment and automation devices . . . designed, engineered, and manufactured by Delta Welder . . . that's the "know-how" which assures lower production costs and improved product quality!

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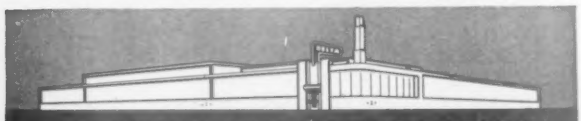
Permit our sales engineers to show you Delta Welder equipment developments and machines that are saving time and money for nationally known manufacturers. Write or call. No obligation. Ph. Texas 4-8446.



DELTA WELDER CORPORATION
8525 Livernois • Detroit 4, Michigan

Metal bending

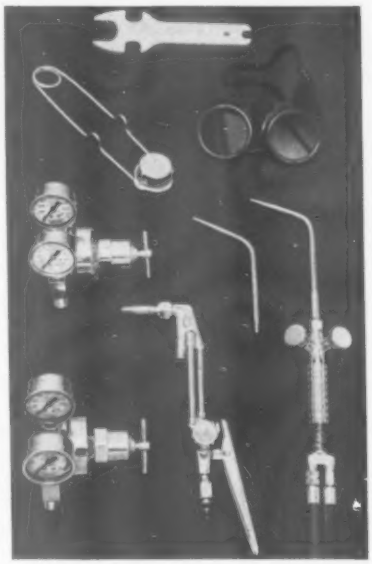
HYDRAULIC press, goose-neck style, is for virtually any heavy metal forming or bending. It accommodates pressures from gentle pinch to full 200-ton squeeze. Press, of welded steel construction, loads from any position within a 300-deg arc. Table has t-slots for anchoring work and tools. Head is also t-slotted for quick change of standard or special tools. *Fjellman American, Inc.*

Circle No. 41

Safety hat

STREAMLINED, lightweight aluminum alloy safety hat is mildew, mold, and fungus-proof, and doesn't mat up with grease and oil. Its full-floating headgear is ribbed for maximum blow resistance and is adjustable. "Superlite" hat has longitudinal ribbing and rolled edge and is equipped with polyethylene head suspension. Available are half-liners and full liners for cold weather. *Boyer-Campbell Co.*

Circle No. 42



Welding and cutting outfit

ABLE to weld metals up to 3/16 in. thick (or 5/16 if larger tips are used) and cut steel plate up to one in. thick, the torch and cutting attachment of a new light-duty outfit weighs only 19 oz. Over-all length is 12½ in. Supplied are two style "8000" single-stage regulators, two twin 3/16-in. gas hoses with connections, style "400" lightweight welding torch with mixer and two tips, style "1490" cutting attachment with one tip, wrench, sparklighter and goggles. *Air Reduction Sales Co.*

Circle No. 43

CO_2 . . . low cost shield for inert gas arc welding

Carbon dioxide is fast gaining acceptance as a most economical shielding medium among fabricators of arc welded mild steel. It's ideal for single or multi-pass applications . . . *manually* or *automatically*.

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LOW COST X-RAY UNIT IS HIGHLY PORTABLE

Never before has so powerful, so portable, and so versatile an X-ray unit been available at so low a price. Radical design improvements make the Baltospot 200 low in cost but high in performance.

Portable but powerful. X-ray head weighs only 85 pounds; rating is 200,000 volts.

Versatile. Baltospot 200's low inherent filtration permits top quality radiographic inspection of materials ranging from thin magnesium sheet to 3" of steel.

Rugged. X-ray unit is elastically supported within a sturdy but light metal housing. It's shockproof, weatherproof, dustproof, waterproof.

Safe, simple to operate. With the Baltospot 200's simplified controls, X-raying is easier than taking a snapshot. Automatic protection devices make it foolproof and safe. *Please write for details.*

OTHER UNITS rated 120 to 260 KV for portable and stationary inspection of material up to 4" of steel. BG 180 for 360° radiography.

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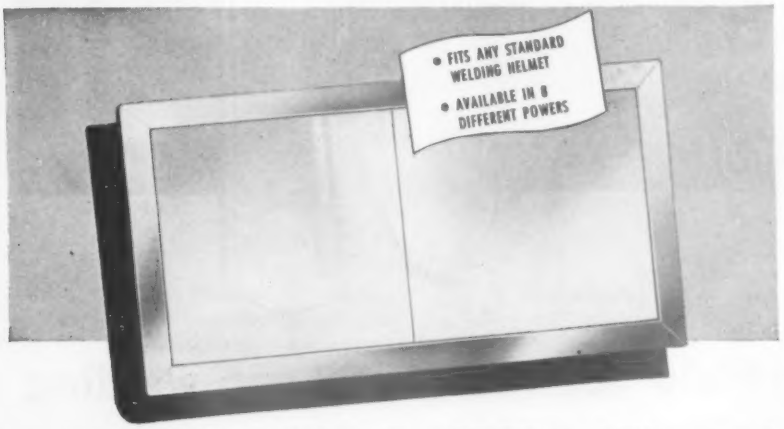


Better Welding Vision For All Bifocal Wearers!

NEW SELLSTROM MAGNA-WELD PLATE

The welder who requires bifocal glasses can now enjoy "full window" vision with the SELLSTROM MAGNA-WELD PLATE. This new optical aid provides magnification for near vision and can be fitted behind colored filter plates in any standard welding helmet.

HOW MAGNA-WELD HELPS

WITHOUT — Helmet wearer cannot use large upper portion of his glasses . . . limited near vision obtained only through bifocal segment.

WITH — Wearer now obtains magnification for near vision provided by MAGNA-WELD throughout entire window area.

WRITE for new Sellstrom Bulletin 33-B

SELLSTROM MANUFACTURING CO.
226 South Hicks Road • Palatine, Illinois

Induction heater

INDUCTION heating unit, 400 cycle, preheats and stress relieves in one continuous cycle without necessity of moving weldment for furnace treatment or other operation. Unit has a strip-chart, proportional program controller for temperature regulation. It is adjustable to desired schedule of heating, soaking and cooling rates. *Hobart Bros. Co.*

Circle No. 44

Electrodes

NEW line of hardfacing electrodes with low-hydrogen coatings, designated "Hardex," includes 14 different types of electrodes, each designed to combat a specific type of wear. Low-hydrogen coatings provide these desirable properties: less moisture in the coating reduces weld porosity; field tests reveal minimum penetration into, and dilution by, base metal, and greater resistance to impact, abrasion and corrosion. Electrodes are packaged in hermetically-sealed, moisture-proof metal containers, and may be used with a-c or d-c. *Metal and Thermit Corp.*

Circle No. 45

Wheel dresser

RUBBERIZED abrasive "Cratex" blocks are used to dress and clean metal-bonded diamond wheels. By flowing around diamond particles, the blocks clean away smear metal, the manufacturer reports. *Cratex Mfg. Co.*

Circle No. 46

Portable heater

NEED for a small, dependable, safe portable heater is met, reports the manufacturer, with the "Silent Glow 120 Cub" heater. It has a heat output of 120,000 btu per hour and burns less than a gallon per hour of either kerosene, No. 1 or No. 2 fuel oil. *Silent Glow Disposal Div.*

Circle No. 47

NEW PRODUCT BRIEFS

Piston pressure switch, "9622" or "C9622," can sense two different pressures in one system and actuate independent electrical circuits at any two desired points. Can sense system pressure over adjustable range of 15-3,000 psi for proof pressures from 3,000-7,000 psi. *Barksdale Valves.*
Circle No. 48

Palm button valve is claimed leakproof; suitable for general applications which require normally closed straightway or three-way hand operated pilot valve. Termed "122 series," valve is 2⅜ in. high. *Ross Operating Valve Co.*
Circle No. 49

Precision level is made of featherweight magnesium, extrudes into I-beam shape with flanged edges turned down full length for added rigidity. Beveled sides give close-line straight edge. Variety of sizes available. *Simplex Level Co., Inc.*
Circle No. 50

Photo-electric control "Robot-eye," features simple design, easy installation, accuracy for control of variety of processes and systems, states the manufacturer. *Standard Instrument Corp.*
Circle No. 116

Silicate mortar is claimed corrosion-proof, designed for acid tanks, stack strength is essential. Termed 'Corlok," mortar withstands strong acids. *Pennsylvania Salt Mfg. Co.*
Circle No. 117

Adjustable ratio speed changer has anodized aluminum end bells; weighs 6 oz. For use in computers, recorders and similar devices requiring remote or automatic control. *Metron Instrument Co.*
Circle No. 118

Force control switch is for use in preventing overload. Available in either tensile load model or compression models. *W. C. Dillon & Co., Inc.*
Circle No. 119

Indicator is combination angle-finding, center-locating and leveling device. Called "Miracle Point" indicator it consists of mercury-balanced level and degree-calibrated dial enclosed and mounted on magnetized V-base. *Racine Instrument Co.*
Circle No. 120

Welding Electrode Production Equipment

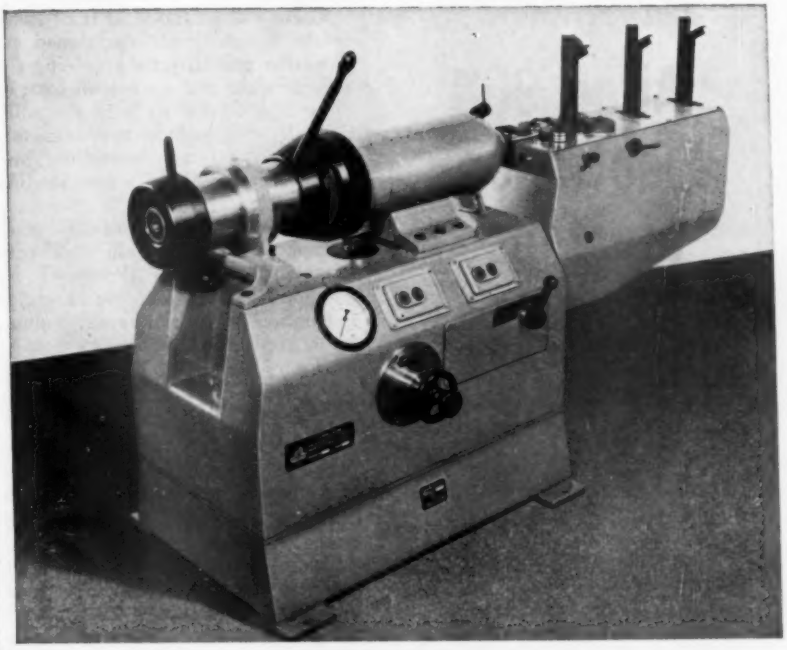
OERLIKON

Developed by the electrode manufacturer—

Built by machine tool makers—

For electrode manufacturers

Automatic batching plants, Mixing equipment, 10 t and 40 t hydraulic Slug Presses, 25 t, 85 t and 200 t hydraulic Extruders, High-Speed automatic Wire Feeders, Brushing Machines, Concentricity and Moisture Testers, Stationary and Continuous Drying Ovens, Laboratory Equipment.



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NEWS . . . . . *from page 6*

steel plates into a stack 12½ in. thick and cutting the entire stack in the shape of a question mark in one operation.

Nelson Stud plans $500,000 expansion

A program calling for expenditure of about $500,000 on its Nelson Stud Welding plant, Lorain, Ohio, during the coming year has been announced by Gregory Industries, Inc.

It will include building additions which will increase Nelson's available floor space by nearly 50%. Other expenditures include an outlay to meet the greatly expanded power requirements of the enlarged plant and to provide increased production equipment and tooling for a new lightweight stud welding gun.

There will be 6,000 sq ft of space in the two-story air-conditioned engineering unit directly adjoining the present plant and an overall total of more than 24,000 sq ft in the addition. It will include approximately 18,000 feet of new warehouse and production space and a new loading dock.

The building will utilize stud-welded sandwich curtain wall construction techniques developed by Nelson and Owens-Corning Fiberglas in conjunction with three major aluminum producers.

Study industrial uses of isotopes

Special General Motors personnel are undergoing intensive 10-week training programs in the industrial uses of radioactive isotopes.

Classes began May 13 for the first group of six divisional engineers at General Motors Institute, Flint, Mich., where a two-week course in fundamentals was presented.

During these remaining eight weeks, trainees are attending a course of lectures and experiments at Technical Center, Warren, Mich., where the physics and instrumentation department of GM's Research Staff are in charge. Headquarters is the isotope research laboratory, one of the largest privately owned facilities of its kind.

The course is planned to give the men a well rounded background in radio isotope uses so they can assist their divisions in evaluating proposed application of radioactive materials to manufacturing and processing problems.

Electrons that kiss and tell

Electron diffraction may provide the answers to inspection problems unsoluble by X-ray, according to the General Electric X-ray Department, Milwaukee. The electron diffraction instrument bounces a stream of electrons off the surface of various materials, producing a pattern that can be used as a guide to better processessing. It is expected to prove useful in such fields as metal plating and powder metallurgy.

A complement to X-ray diffraction, the electrons penetrate less than X-rays. As a result chemical composition and crystal structure can be determined.

This technique is expected to receive the wide application X-ray diffraction now enjoys. Advantages are: crystal size estimates for smaller size range can be determined; electron beam is easier to reduce in size than X-ray beam; sharper patterns can be seen visually on a fluorescent screen, thus it is not necessary to photograph the pattern for some routine control work.

Weldaloy opens western division

Burbank, Calif., is the site of a new plant that will serve as headquarters for the Western Division of Weldaloy Products Co., Van Dyke, Mich.

The newly created division will serve the resistance-welding alloy firm's customers in the western automotive, aircraft, appliance and pipe fabrication fields.

Address of the new plant is 1209 Chestnut St.

Titanium welding report available

Among 16 reports of titanium research now available from the U. S. Dept. of Commerce is one entitled "Welding of titanium and titanium alloys." The research was performed by the Titanium Metallurgical Laboratory at Battelle Memorial Institute and can be purchased for $2.25 from the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.

Another report—on brazing and soldering of titanium—is priced at 75 cents.

Japanese firm triples tool life

Nihon Radio Co. of Tokyo has found that useful service life of bending tools for vacuum tube filament production is tripled when the tool is tipped with an iron-base chromium-tungsten-boron material instead of tungsten carbide. Produced by Wall Colmonoy Corp., Detroit, the alloy is known as "WCR-100."

The tool is similar to a small lathe tool and is used for bending a fine, yet very stable, wire used as the filament in vacuum tubes. The wear encountered is much like that found in a drawing die. Originally tipped with tungsten carbide, the tip required tool replacement every 10 days.

By applying 1/8-in. thick coating of the new alloy to the tip, the tool can be used for 30 days before wear dictates replacement.

Abrasive data package available

An abrasive data sheet package, of interest to all those concerned with abrasive technology, is currently available from the American Society of Tool Engineers, ASTE Data Sheet Service, 10700 Puritan Ave., Detroit 38.

A-L Steel to expand research

Construction will begin shortly on first of three new buildings for the research and development laboratory of Allegheny Ludlum Steel Corp., in Brackenridge, Pa. Included will be annealing, pickling and coating lines for experimental processing.

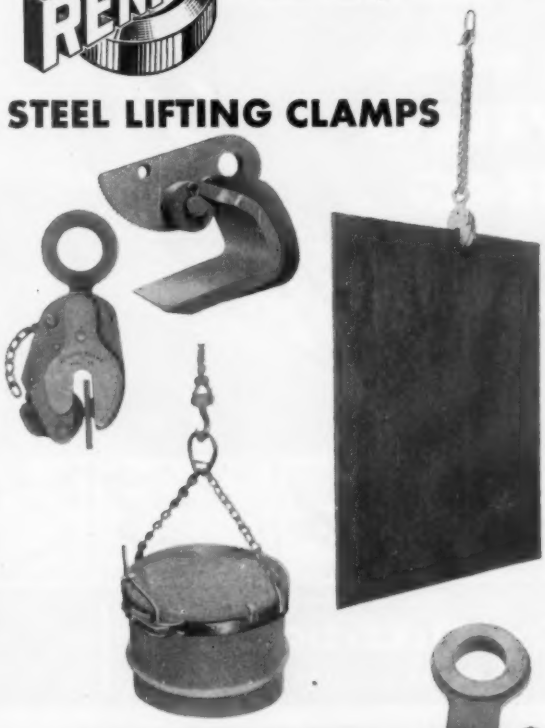
Tracerlab consolidates

Dedication of an ultramodern building in Waltham, Mass., consolidates the east coast operations of Tracerlab, Inc., previously housed in seven separate locations in downtown Boston. The move included nuclear and X-ray equipment, sales offices, engineering and research to the 164,000 sq ft structure.

A unique ceremony opened the new building: principal speaker Sterling Cole (member of Senate and House joint committee on atomic energy) cut a ribbon at the entrance by remote control. He wrote a short statement on a strip of paper which was then measured by a gage utilizing radio-activity to detect the difference in thickness between the plain paper and section containing writing. A switch then set off a small powder charge which cut the traditional dedicatory ribbon.

RENFROE Safety Snap Lock

STEEL LIFTING CLAMPS



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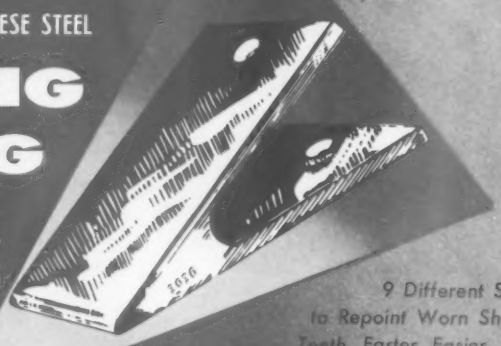

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(Left) "Illustrating the 15 ft. reach collector. Handles large or small work. Units available with 9 ft., 15 ft., 17 ft. and 20 ft. reach."

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Discuss design of cylinders

Fifty delegates from 11 countries attended the first meeting of the International Organization for Standardization subcommittee on compressed-gas cylinder design held in April at The Hague. The Netherlands Commission for Standardization acted as host.

The subcommittee was organized two years ago at the Stockholm meeting of the plenary committee of ISO Technical Committee 58 and charged with the responsibility of creating an international standard for compressed gas cylinders. It discussed every aspect of compressed gas cylinder design, and reviewed the cylinder specifications of the different countries during the four-day Hague meeting.

The interest of the compressed gas industry in the U. S. was represented through the American Standards Association. The ASA delegated to the Compressed Gas Association the responsibility for preparing and presenting the necessary information at the international level.

Delegates were F. R. Fetherston, secretary-treasurer, Compressed Gas Association, and K. G. Jobson, Linde Co., a member of the CGA executive board.

Safety spells longer life

"Near misses" . . . "Keep your guard up" . . . "Stay on your feet" —are some of the titles in a new booklet, "Five minute safety talks for foremen," published by the National Safety Council.

Written by a safety expert, the booklet contains 52 talks on accident prevention with an outline and text for instruction. Topics include latest data on lung safety, hot weather hints, how to use a screwdriver and, last but not least, horseplay! Further information and data from the council, 425 N. Michigan Ave., Chicago 11.

J. M. Ragle incorporates

J. M. Ragle Industries, Kansas City, Mo., has been reorganized and is now a corporation. The business was formerly operated as a partnership between Mr. J. M. Ragle who died recently and M. O. Bollman. Corporate officers are: Mrs. Leolyn Ragle, president; H. O. Bollman, vice president and general manager; W. J. Wilson, secretary and treasurer. The new firm name is J. M. Ragle Industries, Inc.

American Coldset in new plant

American Coldset Corp., manufacturer of precision diamond tools, grinding wheels and coring bits, has moved into its new plant and offices in Teterboro, N. J. The 2½-acre plant site houses expanded fine-tolerance operations and research facilities.

USS offers film catalog

The 18th edition of a catalog describing motion pictures, including five new films, is currently available without cost from United States Steel Corp., Pittsburgh 30. A few of the subjects are building a skyscraper, operation of a Venezuelan ore mine, making of steel, manufacture of wire rope.

Aluminum trailers welded for PIE

Radically lighter in weight but possessing great strength, 50 welded all-aluminum flatbed trailers will soon be delivered to Pacific Intermountain Express. The trailers will transport bulky shipments, such as steel and heavy machinery, on PIE routes in the western U. S.

The trailers are 35 ft long and 8 ft wide, with 4-ft 3-in. bed height. Each weighs 9,640 lb equipped for the road. Use of a Kaiser Aluminum Corp.'s weldable alloy 5083 and consumable electrode welding allowed joining of all structural members and attachment receptacles into an integral unit. The trailers are manufactured by Trailmobile.

Welded office building rises in New York City

A new 26-story office building being constructed at 530 Fifth Ave., New York City, was originally designed for riveting.

It is reported this, and one other structure currently being erected, marks the first use of welding in the city's large office structures.

When completed the 6,000-ton structure will contain 26 stories and a penthouse. All major connections on both beams and columns are welded. Field welding totals almost 12 miles in length.

Welds are being made with 5/16-in. diameter E6010 and E6012 electrodes. Some plate girders, weighing 13 to 15 tons apiece, were welded for the interior of the building, forming the ceiling of a 3-story hall.

West Coast firm spins titanium

Titanium Fabricators, Inc., Burbank, Calif., has developed a process for hot spinning of thick titanium alloy hemispheres. The firm has also developed special machines for the spinning.

First use of the spinning process is in production forming of titanium hemispheres, 15-25 in. diameter, and with gage thickness in excess of ¼ in. The hemispheres are welded, forming spherical pressure vessels for storing such as gases oxygen, helium or carbon dioxide.

Batelle Institute to evaluate metal cutting

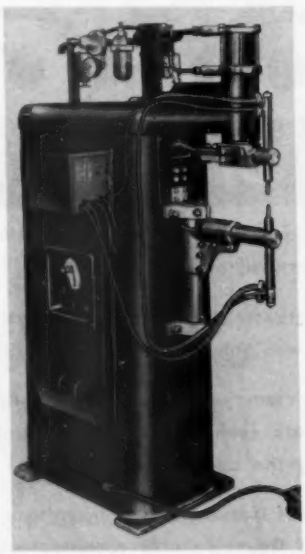
Batelle Memorial Institute will conduct a critical evaluation of metal cutting sponsored by the Research Fund of American Society of Tool Engineers. Batelle will evaluate metal-cutting literature in an attempt to coordinate various theories of metal cutting.

Areas in which further research is needed will be indicated. Based on results of the study, Batelle will prepare a final report carefully outlining all theories of metal cutting that the study has shown to be tenable.

THE VAN VOOREN

WATER-MIZER

MODEL ET 301 P



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- NEW wide-mouth 5 lb. container assures easy removal and prevents waste
- No waste from hardening or crystallization, will not deteriorate with age
- A Soft creamy-flux that applies easily over work surface with a minimum of effort by the operator
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SS

Ultrasonics in industry shown

Ultrasonic applications in industry, and particularly in the jewelry end of it, recently were demonstrated at a symposium sponsored by Gulton Industries, Inc., at the Sheraton Biltmore Hotel, Providence, R. I.

Included was a lecture on ultrasonics in theory and practice. Demonstrations included soldering of aluminum without flux for possible costume jewelry use and also for large scale use in other areas.

18 Air Force men gets tips on X-ray

Eighteen men from Air Material Command posts throughout the United States gathered in Milwaukee for two weeks recently to learn how they can use X-ray in their inspection programs even more effectively than they do now. This additional know-how was obtained from the General Electric X-ray Dept.

Serving as instructors for G-E were A. L. Pace, Dr. E. D. Trout, Dr. J. E. Jacobs and James Heck.

H. K. Porter buys Canadian cable firm

H. K. Porter Co., Inc., has acquired Federal Wire & Cable Co., Ltd., Guelph, Ont. Acquisition of Canada's fourth largest wire and cable concern was made by the Canadian subsidiary of Porter—H. K. Porter Co. (Canada) Ltd.

Alcoa film depicts aluminum versatility

Aluminum is presented in chameleon role in metals in a 16mm sound-color film entitled "Man on a Skyhook." The 18-minute film portrays today's practicalities and tomorrow's possibilities of design with the light metal. Film is available on loan from Motion Picture Section, Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19.

Special welder for Kelvinator

A 19-station welding and forming machine will be an important part of nearly $4,000,000 worth of tools to be added this year to the main appliance plant of Kelvinator, Grand Rapids. The machine will occupy 150 ft of floor space and will operate as a special through-feed, handling, forming and welding line for refrigerators.

To build nuclear center

A contract for design and engineering of the industrial nuclear center of Case Institute of Technology, Cleveland, has been awarded to the Austin Co. The center is planned under the joint sponsorship of Case and industrial firms interested in types of research which require a high flux engineering test reactor.

Armour Research plans expansion

Ground was broken last month for a $1,100,000 building addition at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The four-story addition will be constructed at the north end of the ARF Metals Research Building. Rapid expansion in metals research has necessitated construction of the 144-foot addition.

Pump in welder solves problem

Incorporation of a short-setting turbine pump into what has been called the largest rotary electric welder ever built has solved a cooling problem. McKay Machine Co., Youngstown, Ohio, manufactured the 11½-ton welder, part of a 12-in., electric weld pipe mill. Transformer coolant to be used had a low lubricating value, preventing use of gear pumps. The turbine pump solved the problem.

Weldor wins $8,960 award

For suggesting a better way to build steam turbines, Robert Bellar, a weldor in the turbine department of Westinghouse Electric Corp.'s steam division, Lester, Pa., received an award of $8,960. His suggestion that extension pieces at each steam inlet sleeve could be made integral with the turbine cylinder casting has reduced welding time for each cylinder.

Norelco changes division name

The Instruments Division, North American Philips Co., Inc., Mount Vernon, N. Y., is now known as the Instruments Division, Philips Electronics, Inc. The parent company is still North American Philips, Inc., New York City.

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IMPROVE WELDING QUALITY WITH THE **TONG TEST**

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Now you can measure actual AC or DC welding currents without losing valuable production time. The Columbia TONG TEST is simply clamped around the electrode cable. Instantly you get an accurate ampere reading to control and maintain welding quality. Interchangeable ranges available up to 1000 amperes.

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Suspended transformer type spot welders can waste as much as half the power between the separate transformer and the gun. In addition, the heavy connecting cables get in the way and slow the operator. The original cost of gun plus separate transformer is excessively high and, added to this, is the high cost of special wiring.

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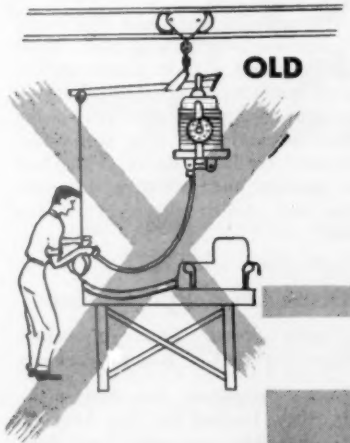

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C-F Positioners are available in Hand or Power operated models, and are made in capacities up to 30,000 lbs. and larger.

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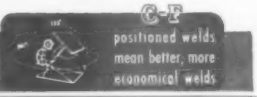

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COMING EVENTS

JUNE 11-13: Third Western Plant Maintenance & Engineering Show, Civic Auditorium, San Francisco.

JUNE 19-21: Summer Meeting, Compressed Gas Association, Seaview Country Club, Absecon, N. J.

JUNE 28-JULY 14: Chicagoland Fair, Chicago Association of Commerce & Industry, Navy Pier, Chicago.

JUNE 29-JULY 6: Annual Assembly, International Institute of Welding, Essen, Germany.

JULY 1-3: Summer Meeting, Independent Oxygen Manufacturers' Association, Broadmoor Hotel, Colorado Springs, Colo.

Dayton AWS holds design clinic

A one-day welding design clinic was held April 23 by the Dayton section of the American Welding Society. Conducted by Roy D. McCauley and William L. Green of Ohio State University's Dept. of Welding Engineering, it was the third such program in as many years.

Topics discussed were engineering concept of a weld, fundamentals of machine design, redesign of machine frames and components for welding, and recent developments in the welding field.

Tumbling for engine parts

To speed production of complex stainless steel jet engine parts, Solar Aircraft Co.'s Des Moines, Ia., plant uses specially designed tumbling machines to smooth edges of large precision assemblies.

The new machines look like rotary laundry washers with a drum about 6 ft long and 4 ft in diameter. The barrel contains an abrasive charge—a mixture of aluminum oxide chips, pieces of mild steel wire and water. Jet parts are held rigidly as the barrel rotates and abrasive mixtures hone and polish sharp edges and nicks.

Distributor appointments

Ampco Metal, Inc. Milwaukee: Oxygen Service Co., Kingsport, Tenn.

United Specialties, Inc., El Dorado, Ark.: Ray Hammel Co., Los Angeles; J. G. Ward & Associates, Inc., Portland, Ore.; Porter Littell Sales Co., Denver.

William M. Haile is the new president of Linde Co. His first position with Linde was in the New Orleans office. In 1952 he became manager of the eastern region and in 1955, vice president.

James W. Dunham, vice president of National Cylinder Gas Co., has been elected to that firm's newly created post of chairman of the finance committee. *W. W. Whitnell*, secretary and controller, has been elected a vice president.

J. F. Forster was recently appointed executive vice-president of Vickers, Inc., Detroit. He will have direct charge of all Vickers operations.

Roger J. Cesvet has been appointed director of research and development for the building products division of American Welding & Mfg. Co., Warren and Niles, Ohio. *William J. Cave, Jr.*, has been promoted to assistant purchasing agent.

Berkley Neustadt has been elected a director by the board of The Liquid Carbonic Corp., Chicago. He fills the vacancy created by the resignation of *H. P. Snyder*.

Lee S. Wade has been named general sales manager for All-State Welding Alloys Co., Inc. He had been regional manager for a large portion of the midwest since 1955. Wade has been affiliated with welding for more than 15 years, much of it as a welding consultant in construction and maintenance.

Walther H. Feldmann has been elected president of Worthington Corp., succeeding *Edwin J. Schwanhausser* who becomes vice chairman of the board.

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The Practical Lighter for welding and cutting torches

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213	475	1400
225	488	1450
238	500	1500
250	550	1550
263	600	1600
275	650	1650
288	700	1700
300	750	1750
313	800	1800
325	850	1850
338	900	1900
350	950	1950
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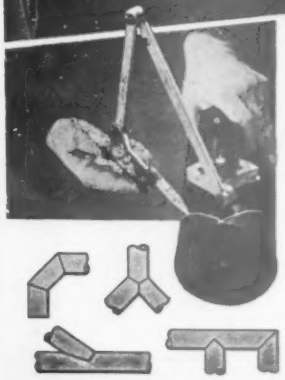

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Lindsay

Price

Donald R. Lindsay has been appointed assistant to the sales manager, Industrial Gas Division, The Liquid Carbonic Corp. His activities will be closely associated with the firm's stepped-up program in manufacture of liquid oxygen, liquid nitrogen and liquid argon in various parts of the U. S. He will headquarter in the Chicago general office. *William E. Price* has been named sales manager, industrial and medical equipment. In his new post in Chicago, Price will direct sales promotion on various lines of apparatus and supplies which Liquid in introducing for the welding and oxygen therapy fields.

Samuel S. Auchincloss was recently elected president and chairman of the board of Tracerlab, Inc., Waltham, Mass. He succeeds *William O. Faxon* who resigned the presidency but will continue as a consultant. Auchincloss was president of Cleveland Welding Division, American Machine and Foundry Co.

F. John Pichard has been named manager, standard equipment sales, Wheelabrator Corp., Mishawaka, Ind. He had previously been district sales engineer in New York City.

Leo E. Gatzek has been appointed supervisor of the heat treating department and plating and welding department at Pacific Division, Bendix Aviation Corp., North Hollywood, Calif. He will continue as head of the metallurgical laboratory.

Quentin M. Bloom has been named manager, furnace and kiln division, and *Charles A. McFadden* has been named manager, general industry division, by Selas Corp. of America, Dresher, Pa.

Donald H. Turner was recently appointed supervisor of melting and heat treating services at Armour Research Foundation of Illinois Institute of Technology, Chicago. *Dr. Arthur G. Metcalfe* has been named supervisor of physical metallurgy.

Jack R. Barckhoff and *David J. Nangle* have joined The Lincoln Electric Co.'s district offices at Minneapolis and Union, N. J., respectively.

Eugene H. Conway has been named vice president and manager by The Gasflux Co., Elyria, Ohio.

Earl A. Neeb has been appointed plant manager of the Toronto, Ohio, plant of Titanium Metals Corp. of America. He was formerly associated with Allegheny Ludlum Steel Corp.

John Ross has been appointed district sales manager for the west coast by The American Platinum Works, Newark. He will specialize in silver brazing alloys.

John Cutirilo has been appointed to the welding unit of the Materials & Processes Laboratory of General Electric Co.'s steam turbine-generator department. He will carry out research of gas and arc welding. He is a member of the American Welding Society.

I. W. Evans has been promoted to chief engineer of cranes by The Morgan Engineering Co., Alliance, Ohio. He moves up from his old post of chief development and welding engineer, after only three years at Morgan. A member of AWS, ASM, and AISE, Evans is credited with steps Morgan has taken toward enlarging and modernizing its welding and structural facilities.

John P. Lynn has been named manager of manufacturing for The American Welding & Mfg. Co., Warren & Niles, Ohio. He has been assistant manager of manufacturing since 1955. He was previously associated with Wright Aeronautical division of Curtiss-Wright Corp.

James P. Coughlin, who recently left Eutectic Welding Alloys Corp., has joined the Cushioning Products Division of Armour and Co., Alliance, Ohio.

Howard A. Blair has been named maintenance engineer for American Welding & Mfg. Co., Warren & Niles, Ohio. He was previously assistant chief engineer.

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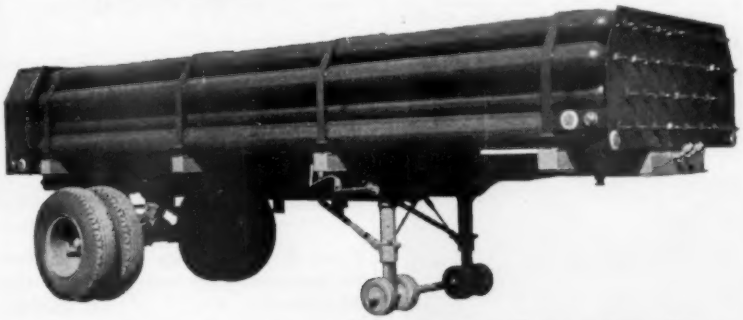

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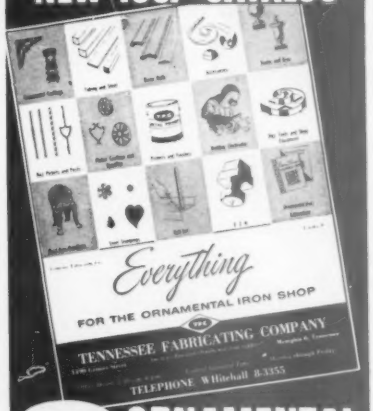

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H. J. Meany has been appointed manager of the Texas division, Waco, for Norris-Thermador, Corp., Los Angeles.

H. T. Ross was recently named vice president of engineering by Linde Air Products Co., New York City. He was previously manager of engineering.

John C. Wallace has been named vice president of engineering for Walworth Co., manufacturer of valves and fittings. He was formerly vice president and general manager of Hunt-Spiller Mfg. Corp., Boston.

John B. Cleeves has been appointed manager of finance for General Electric Co.'s welding department. York, Pa. He succeeds *Elton A. Turner*, named manager of finance for the company's Metallurgical Products Department, Detroit.

C. D. L. Perkins has been promoted to assistant sales manager for the Philadelphia district of Air Reduction Sales Co. He had been sales assistant in the same district. He joined Airco in 1950.

R. F. Wilson, formerly with General Electric Co.'s welding department, has joined the firm's Metallurgical Products Department, Detroit. He will develop and apply operations research methods to cemented-carbide activities.

Ernest L. Richmond has been appointed chief engineer for Worthington Corp.'s Plainfield, N. J. division. Joining the engineering department in 1945, he has made many contributions to development of welding positioners and turning rolls. *Douglas L. Heisler* has been named purchasing manager of the Harrison, N. J. division following the retirement of *George F. Guldner*. *Charles D. Cummins* has been named district manager of the firm's Seattle Wash., office. He succeeds *E. D. Schively*, who has accepted special assignment in the firm's Canadian operation.

Died . . .

A. B. Kime, eastern regional supervisor for Worthington Corp.'s positioning equipment, died April 28. He was 57. A member of AWS, Mr. Kime was previously associated with The Lincoln Electric Co. and Federal Shipbuilding Corp. He joined Worthington in 1947.

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Established, growing Cleveland manufacturer of gas welding and cutting equipment. Send complete resume indicating salary desired to: Box No. 624, c/o Welding Engineer, 12 E. Grand Ave., Chicago 11, Ill.

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Your cost for this service: Only $1.25 ea. Over 100 at $1.00 ea. Terms: 2% 10 days.
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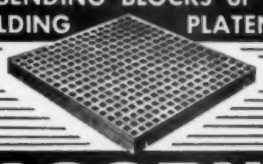

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51. RESISTANCE WELDER — Taylor-Winfield Corp. Bulletin 8-413 describes and illustrates resistance welders to mass-produce electrical contact, conductor and terminal assemblies.

52. WELDING OUTFIT—Air Reduction Sales Co. Information on new welding and cutting outfit for light-to-medium work range.

53. FEED-IN DUCT—Square D Co. Literature explains line of totally-enclosed aluminum feed-in ducts requiring no derating.

54. CLEANER—Easy Tip. Bulletin gives data on longer-length cleaners for oxy-acetylene cutting torch tips.

55. FURNACE—American Gas Furnace Co. Details on automatic "Twin-Hearth" heat-treating furnace processing up to 800 lb of work per hour.

56. REST BUTTONS—Jergens Tool Specialty Co. Diagrams, charts of dimensions, etc., supplied in catalog on alloy steel rest buttons for jigs and fixtures.

57. FORCING PRESS—Fjellman American, Inc. Literature gives specifications of new "absolute control" 200-ton utility forcing press.

58. BRAZING ALLOYS—Handy & Harman Co. Folder contains data on vacuum-tube grade silver and gold brazing alloys in wire, strip and sheet form.

59. WHEEL DRESSING—Cratex Mfg. Co. Literature depicts new method of dressing and cleaning metal-bonded diamond wheels.

60. WATER SAVER—Van Vooren Products. Circular explains "Water Mizer," which cuts water waste by coolant control for resistance welders.

61. WELD CLEANER—Weldon Roberts Rubber Co. Sample can of "Brightboy" compound for removing weld heat marks available to firms willing to report on use.

62. HARDFACING ELECTRODES—Metal & Thermit Corp. Booklet outlines "Hardex" line of 14 hardfacing electrode types.

63. SHEET DESCALING — Wheelabrator Corp. Eight-page bulletin 128-D contains six-company report on low-cost mechanical descaling of carbon, hot-rolled and stainless steels.

64. TORCHES—Linde Co. Six-page form 1007 describes three "Oxweld" welding torches operated on low-pressure acetylene (less than 1 psi). Performance data on welding and cutting tips included.

65. TESTING INSTRUMENT—Branson Instruments, Inc. Eight-page bulletin V-200 offers time-saving advantages of "Vidigage," ultrasonic resonance instrument for nondestructive testing.

66. FACE SHIELD—Pulmosan Corp. Illustrated page describes new plastic face shield.

67. NOZZLE COMPOUND—Linde Co. Folder 1049 treats new silicone-alloyed "65 Compound" which forms thin protective coating over bore and mouth of Mig welding nozzle to prevent spatter pick-up.

68. ENGINEERING SERVICE—Carborundum Co. Brochure explains "Maximum automation potential," free engineering service to predict performance of abrasive belts on metal removal operations.

69. BIFOCAL LENS—Sellstrom Mfg. Co. For weldors who wear glasses, bulletin 33-B discusses new "Sellstrom Magna-Weld Plate," bifocal lenses installed behind regular helmet lens to give full magnification.

70. GRINDING CUP—Raybestos-Manhattan, Inc. Bulletin 7157 discusses steel "Safety Back" grinding wheel cover.

71. TORCH HANDLE—Linde Co. Catalog F-6995 treats "Prest-O-Lite No. 403" torch handle with needle valve at rear of handle.

72. WELDING CONTROLS—Taylor-Winfield Corp. Bulletin SP-19 uses diagrams to illustrate operation of new resistance welding controls.

73. AIR GAGE—Freeland Gauge Co. Illustrated folder treats new comparator air gage model "L" which works on back-pressure circuit principle.

74. WELDING POSITIONERS—Aronson Machine Co. Bulletin No. HD57 gives descriptions and specifications for 8 gear-driven welding positioner models with 500 to 24,000 lb capacity.

75. LADDERS—Tri-Metal Ladder Co. Two-color sheet illustrates new 8 to 12 step, all-welded steel safety ladders.

76. GAS REGULATORS—Air Reduction Sales Co. Forty-page catalog 806 covers complete line of pressure regulators for industrial compressed gases. Graphs of flow and pressure data included.

77. STUD WELDING—Nelson Stud Welding Div. Desk or pocket-size operation manual 5 explains how to get best results from stud welding equipment, includes trouble-shooting chart.

78. BRAZING—Handy & Harman. Illustrated booklet 76 gives examples of silver alloy brazing and introduces "Handy Alumibraze," new method for joining aluminum, described more fully in bulletin 23.

79. CLIPS—Mueller Electric. Index and samples of electric clips available. Eight-page catalog emphasizes welding ground clamps and test clips.

80. PNEUMATIC SPECIALTIES—Watts Regulator Co. Air filters, pressure regulators and lubricator combination units catalogued in folder F-15B.

81. WELDING ALLOYS—Eutectic Welding Alloys Corp. "Selec-Tic" wall chart helps choose best welding alloy for job. Gives bonding temperatures, tensile strengths possible and Rockwell hardnesses.

82. RESISTANCE WELDING — Taylor-Winfield Corp. New 24-page bulletin SP-18 gives photos and descriptions of over 300 products mass-produced by resistance welding.

83. PIPE CUTTER—Steffan Engineering. Brochures cover "Mechanical Draftsman" pipe contouring machine and "Mechanical Hole Cutter" to prepare pipes for welding.

84. WELDING PROCESS — Linde Co. Results of production line test on "Unionarc" welding process presented in 8-page brochure "A better way to weld steel."

85. LENSES—Magna Co. Leaflet on "Magna-Lens," individual prescription glasses installed in weldor's helmet.

86. TOGGLE CLAMPS—Detroit Stamping Co. Big catalog 57 lists features and differences of a variety of clamp models available. Price list, distributors and bulletin 810-858 on three new air-operated toggle clamps included.

87. INDUCTION MOTORS —International Rectifier Corp. Brochure explains direct-current braking for a-c induction motors to replace or aid mechanical brake.

88. BRONZE ELECTRODES — Ampco Metal, Inc. "Ampco Welding News" describes savings in use of bronze electrodes and filler rods. Includes information on overlay of tool steel forming dies and attachment of wear plates.

89. STEEL STAMPS—M. E. Cunningham Co. Four-page bulletin includes safety steel stamps, holders and fixtures, plus charts for ordering.

90. ARC WELDING—Linde Co. "New continuous-feed arc welding," bulletin F-1076 depicts development and application of "Unionarc" welding process.

91. METER RELAYS—Assembly Products, Inc. Attractive 40-page catalog 4-c treats instruments that indicate and control physical or chemical conditions detected electrically.

92. GAS EQUIPMENT—Linde Co. Catalog 4486 describes industrial gas manifolds with automatic controls.

93. HARDFACING ELECTRODES—Sight Feed Generator Co. New 20-page manual "Rexarc engineered toughness" illustrates typical buildup and hardfacing applications for better wear resistance.

94. RESEARCH—Selas Corp. of America. "An approach to interpretive research," 24-page brochure S-1053 discusses firm's laboratory facilities.

95. RESISTANCE WELDING — Taylor-Winfield Corp. Special machine bulletin 8-413 describes 32 multi-spot and projection welding machines.

96. WELDING PROCESS—Trent Tube Co. Full color, 48-page catalog introduces "Contour Trentweld," welding pipes and tubes from bottom instead of at top. Section on titanium tubing, 17 tables included.

97. MOLY SHEET—Fansteel Metallurgical Corp. Price list 4.604 available, lists stock and mill sizes of pure molybdenum sheet.

98. SPOT WELDER—Guthery Machine Tool Corp. Illustrated sheet explains water-cooled welding guns P 293, heavy duty machine for all types of sheet metal work.

99. WELDING HELMETS—Kedman Co. Complete price sheet (NWSA Index 930) on "Huntsman" welding helmets. Model 411 weighs less than 19 oz.

100. SOLDERING—Castle Machines, Inc. Attractive leaflet describes "Braze-o-matic" automatic soldering equipment.

101. CUTTING TIPS—Trippe Supply Co. Price lists provided for cutting tips for all torches, with illustrations of various tips.

102. WELDING PROCESS—Linde Co. Booklet F-1066 deals with weld quality of new "Unionarc" welding process.

103. REGULATOR—Watts Regulator Co. Catalog covers line of combination units for automatic filtration, regulation of air supply to pneumatic equipment.

104. WELDOR'S GEAR—Hobart Bros. Co. Leaflet lists such arc welding equipment as headshields, gloves, goggles.

105. WELDERS — Taylor-Winfield Co. Special 12-page bulletin 8-413 specifies product, operation, production rate and machine descriptions for multi-spot and projection welders.

106. CARBIDE TOOLS—Adamas Carbide Corp. New 32-page catalog 357 illustrates complete line of tungsten carbide tools, tool tips, dies.

107. ALLOYS—Henning Bros. and Smith. Wall chart 17 x 22 in. details information on 37 standard brass, bronze and nickel-silver casting alloys.

108. REMOTE CONTROLS—Controlex Corp. of America. Folder gives engineering data on "Controlex" ball-bearing remote control unit which can manipulate 300 lb.

109. PYROMETERS — Minneapolis-Honeywell Brown Instruments. Buyer's guide 100-6 lists pyrometer supplies, thermocouple assemblies and components.

110. WELDING EQUIPMENT—General Electric Co. Bulletin GEC-1334B on "Filler-arc" welding equipment includes application information, product features, specifications.

111. WELDING CABLE—Walker Bros. Bulletin No. 357 details arc welding cable; includes cable selection chart. Features rubber or neoprene insulation, fine-stranded copper.

112. BRONZE ROD—Aufhauser Bros. Corp. Sheet describes low fuming, all-purpose manganese bronze rod "No. 1" for gas welding. Lists physical properties.

113. TUBES, FITTINGS—Babcock & Wilcox Co. Booklet 145-A gives condensed data on analysis, mechanical and physical properties, hot and cold bending, welding, heat treatment and working pressure of "Croloy" steel pipe, tubing and welding fittings.

ADVERTISERS IN THIS ISSUE

This advertisers' index is included as a convenience and is in no way part of the advertising contract. Although every care has been taken to index accurately some errors may have occurred and no allowance will be made for them.

Airline Welding & Engineering.... 10
Air Products, Inc.,
K-G Equipment Co., Inc..... 59
Air Reduction Co., Inc.,
Jackson Products.....Front Cover
Pure Carbonic Co..... 97
Air Reduction Sales Co.....12, 100
Allen Co., Inc., L. B.....110
Allied Welder Corp..... 51
Alloy Rods Company.....20-21
All-State Welding Alloys Co., Inc. 106
American Chain & Cable Co., Inc.
Page Steel & Wire Div.....64-65
American Optical Co..... 87
Ampco Metal, Inc..... 55
Arcos Corporation 94, 95
Aronson Machine Co..... 84
Aro Spot Welder Div.,
Guthery Machine Tool Corp.....105
Atlas Welding Accessories, Inc..... 8
Aufhauser Bros. Corp.....110

Balteau Electric Corp..... 98
Bay-State Abrasive Products Co..... 11
Becker Bros. Carbon Co.....109
Bernard Welding Equipment Co.. 9
Bridgeport Brass Co..... 90
Budd Company 19

Caddy Arc Welding Accessory Div.,
Erico Products, Inc..... 2
Cam-Lok Division,
Empire Products, Inc..... 92
Chicago Hardware Foundry Co..... 62
Columbia Electric Mfg. Co.....105
Contour Marker Corp.....108
Crucible Steel Co. of America..... 89
Cullen-Friestedt Co.....106

Delta Welder Corp..... 96
Drawalloy Corporation 67

Eastman Kodak Co..... 49
Eisler Engineering Co., Inc..... 82
Electrons, Inc..... 86
Empire Products, Inc.,
Cam-Lok Division 92
Erico Products, Inc., Caddy Arc
Welding Accessory Div..... 2
Eutectic Welding Alloys Corp..... 85

Fibre-Metal Products
Co. .....Inside Front Cover
Foote Mineral Co..... 27

General Cable Corp..... 15
General Electric Co.....24-25
General Electric Co.,
Specialty Control Dept.....71, 72-73
Guthery Machine Tool Corp.,
Aro Spot Welder Div.....105

H & M Pipe Beveling Machine Co. 88
Harnischfeger Corp. 26, 93
Hobart Bros. Co.....1, 82

Independent Engineering
Co., Inc. 109
International Nickel Co.,
Inc. .....79, Outside Back Cover

Jackson Products, Div. of Air
Reduction Co., Inc.....Front Cover

K-G Equipment Co., Inc.,
Div. of Air Products, Inc..... 59

Lenco, Inc. 108
Lincoln Electric Co..... 28
Linde Co., Div. of Union
Carbide Corporation.....62, 83

Magna Company 53
Magnaflux Corporation 63
Mallory & Co., Inc., P. R..... 57
Manhattan Rubber Div.,
Raybestos-Manhattan, Inc. 81
Merrill Brothers 70
Metal & Thermit Corp..... 61
Miller Electric Mfg. Co., Inc.....76-77

National Carbide Co.....104
National Lead Co.,
Titanium Alloy Mfg. Div..... 66
National Welding Equipment Co. 7
Norton Company 16

Oerlikon Machine Tool Works,
Buehrle & Company..... 99

Page Steel & Wire Div., American
Chain & Cable Co., Inc.....64-65
Pure Carbonic Co..... 97

Raybestos-Manhattan, Inc.,
Manhattan Rubber Div..... 81
Renfroe & Sons, Inc., J. C..... 101
Ruemelin Mfg. Co.....102

Sellstrom Manufacturing Co..... 98
Shawinigan Products Corp..... 62
Shoot-A-Lite Corp. 107
Smith Corp., A. O.....68-69
Steel Sales Corp.....104
Stoody Company 47
Stulz-Sickles Co. 102
Superior Air Products Co..... 82

Tee Torch Co., Inc.....110
Tempil Corporation 107
Tennessee Fabricating Co.....110
Tickle Engineering Works, Inc.,
Arthur 53
Titanium Alloy Mfg. Div.,
National Lead Co..... 66
Tube Turns, Inc.....17-18
Tweco Products, Inc.
.....Inside Back Cover

Union Carbide Corp.,
Linde Company 62, 83
United Wire & Supply Corp..... 14

Van Vooren Products.....103
Victor Equipment Co.....4, 30

Westinghouse Electric
Corporation 22, 91

Literature offered in ads

If you wish to receive any of these items listed here, use card on opposite page.

125. Airline Welding & Engineering—Technical and general information on welders and planishers.

126. Air Reduction Sales Co.—Catalog 1318, "Airco Electrode Guide" to help you select the right electrode for your specific job.

127. Air Reduction Sales Co.—Complete information and literature on using "Aircomatic" process for low cost inert-gas arc welding of mild steel.

128. Allen Co., Inc., L. B.—Information on fluxes for soldering, brazing and welding.

129. Allied Welder Corp.—Information on standard welders, welding guns and special equipment problems.

130. Alloy Rods Co.—Facts on iron-powder, low-hydrogen "Atom.Arc DH-12" electrodes.

131. All-State Welding Alloys Co., Inc.—Step-by-step guide, "Instruction Manual," for operators who weld, braze, solder, tin and cut without oxygen.

132. American Optical Co.—Details on engineered "AO F5100" safety glasses for comfortable eye protection.

133. Ampco Metal, Inc.—Bulletin W-17 contains information on "Phos-Trode" all-purpose phosphor-bronze electrode and other Ampco electrodes.

134. Aronson Machine Co.—Detailed information on positioners.

135. Aro Spot Welder Div.—Illustrated literature on portable spot welders.

136. Atlas Welding Accessories, Inc.—Data on complete weld-cleaning tool line.

137. Balteau Electric Corp.—Details on new, low-cost X-ray portable unit.

138. Bay-State Abrasive Products Co.—New catalog gives details of complete weld grinding line.

139. Becker Bros. Carbon Co.—Catalog on carbon brushes for all makes of welding equipment gives complete specifications.

140. Bernard Welding Equipment Co.—Information on "Shortstub" electrode holders.

141. Bridgeport Brass Co.—Booklet, "Bronze Welding Alloys."

142. Budd Co.—Details on "Multitron" Radiography Machines that do more jobs for less money.

143. Cam—Lok Div.—Catalog and full details on portable cable splicing kit.

144. Chicago Hardware Foundry Co.—Folder on "Flux-Well" welding fluxes.

145. Columbia Electric Mfg. Co.—Catalog WE-400 on the "Tong Test" a-c/d-c ammeter.

146. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

147. Crucible Steel Co.—Data on "Rex-weld A" hardfacing rods for production and maintenance.

148. Cullen-Friestedt Co.—Low-cost welding "C-F Positioner Catalog."

149. Delta Welder Corp.—Details on how equipment developments and machines can save you time and money in high production resistance welding.

150. Drawalloy Corp.—Bulletin 355-DC provides complete information on every grade of Drawalloy wire.

151. Eastman Kodak Co.—Details on how radiography can save you money and keep the quality of castings high and data on Industrial "Type AA" X-ray film.

152. Eisler Engineering Co., Inc.—Information on resistance-welding and general welding equipment.

153. Electrons, Inc.—Details of reliability of "ELC16J" thyratrons in bench welder controls.

154. Erico Products, Inc.—Details on "Caddy" cable splicing with "Cadweld" connections.

155. Eutectic Welding Alloys Corp.—Data on high-speed electrodes for gouging, chamfering and piercing all metals without oxygen and details on low-temperature alloys for repairing heavy base castings.

156. Eutectic Welding Alloys Corp.—Details on high-strength, "brazing type" alloy for joining steel and other metals; also alloy for high-tensile strength in repairing; and copper-base, silver-bearing, thin-flow alloy that produces high-strength joints on close fitting operations.

157. Eutectic Welding Alloys Corp.—70-page booklet, "Welding Data Book."

158. Fibre-Metal Products Co.—Bulletin 55 on new "Superlite" aluminum safety hat and other safety equipment.

159. Foote Mineral Co.—Informative brochure, "Raw Materials For Welding Rod Coatings."

160. General Cable Corp.—Details on how aluminum welding cable makes your job easier.

161. General Electric Co.—Descriptive Bulletin GEA-6423 on new d-c motor-generator welding sets.

162. General Electric Co.—Data on new cost-cutting, non-synchronous controls for resistance welding applications.

163. General Electric Co.—Information and Bulletins GEA-6408 (Standardline) and GEA-6593 (Customline).

164. H & M Pipe Beveling Machine Co.—Illustrated bulletin on "Model O" pipe cutting and beveling machine for greater speed, accuracy, precision and profits in joining small diameter piping.

165. Harnischfeger Corp.—Data on "P&H" low-hydrogen electrodes to match the chemical or mechanical properties of any problem alloy.

166. Harnischfeger Corp.—Bulletin R-29, "P&H Smootharc Welding Electrodes."

167. Hobart Bros. Co.—Information on a-c/d-c combination, electric motor drive, standard gas engine drive and d-c rectifier welders.

168. Hobart Bros. Co.—Details on a-c welder/a-c power combination and a-c/d-c combination with inert gas facilities welders.

169. Hobart Bros. Co.—Data on a-c transformer and catalog on new iron-powder electrodes.

170. Hobart Bros. Co.—Information and samples on "Hobart 413" general purpose, all-position, a-c or d-c electrode.

171. Hobart Bros. Co.—Catalog on electrodes and catalog on arc-welding machines.

172. Independent Engineering Co., Inc.—Details on how to reduce cylinder handling with gas supply trailers.

173. International Nickel Co., Inc.—Booklet, "Inco Welding Products," describes the "140" Monel series of electrodes and all other electrodes, wire, rods and fluxes for joining high-nickel alloys to themselves and other metals.

174. International Nickel Co., Inc.—Helpful folder gives data on many test welds made with "Inco-Rod A" electrode.

175. Jackson Products—Information on electrode holders, fiber-glass welding helmets and other safety and protection equipment.

176. K-G Equipment Co., Inc.—Information on "M38 Torch" for every hand cutting operation.

221. Lenco, Inc.—Information on "Hi-Amp" electrode holders.

177. Lincoln Electric Co.—Weldirectory SB-1354 gives specifications on Lincoln agglomerated fluxes.

178. Linde Co.—Booklet on how "X-7" anti-spatter compound saves time and cuts costs.

179. Linde Co.—Catalog F-4487 gives details on complete line of dependable "Oxweld" portable cutting machines.

180. Magna Co.—Descriptive folder on "Magna-Lens" prescription lenses inserted directly in welding helmet in plastic frame.

181. Magnaflux Corp.—Information on testing systems that can save money and improve the quantity and quality of your welding.

182. Mallory & Co., Inc., P. R.—Details on standard Mallory tips to fit your special resistance welding jobs and name of distributor serving your area.

183. Manhattan Rubber Div.—Details on "Moldiscs" portable grinding wheels, portable wheels, cut-off wheels and centerless wheels for every cutting or grinding operation.

184. Merrill Bros.—Information on lifting clamps, twin and drum lifters, drum tilter and other material handling devices.

185. Metal & Thermit Corp.—Manual with selector chart listing the right "Hardex" electrode for over 200 hardfacing applications.

219. Metal & Thermit Corp.—Booklet S-56 on proper selection and application of "M&T" stainless electrodes.

(Continued on page 116)

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page.

Also information about

NEW PRODUCTS described on pages 80 to 98

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For copies of any manufacturers' bulletins described on these pages, circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

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51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250

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Literature offered in ads

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(Continued from page 114)

220. Metal & Thermit Corp.—Full details on "M&T" Controlled Arc Power Supply" welder for automatic welding.

186. Miller Electric Mfg. Co., Inc.—Complete particulars on "Gold Star SR" d-c arc welder.

187. Miller Electric Mfg. Co., Inc.—Details and demonstration on how "Gold Star SR" welder gives over-all improvement in d-c welding performance with a single machine.

188. National Carbide Co.—Write for name and address of nearest supplier.

189. National Welding Equipment Co.—Brochure 8, "air-gas torches by National," illustrates and describes torches and operations.

190. Norton Co.—Folder, "From Roughing To Finishing," contains complete information on the semi-flexible "BFR" wheel for light weld grinding and the rigid "BD" hub-type wheel for heavy weld grinding.

191. Oerlikon Machine Tool Works—Detailed information in Oerlikon welding electrode production equipment.

192. Page Steel & Wire Div.—Folder DH-402A, "Page Submerged Arc and Inert Gas Welding Wire."

193. Page Steel & Wire Div.—Booklet DH-1277, "Page Gas Welding Rods."

194. Page Steel & Wire Div.——Typical uses of various rods in "Welding Rod Comparison Chart" and detailed physical properties.

195. Pure Carbonic Co.—Information on gas, liquid or solid CO_2 inert gas arc welding shield for industrial uses.

196. Renfroe & Sons, Inc., J. C.—Complete Catalog on steel lifting clamps for handling steel with safety and efficiency.

197. Ruemelin Mfg. Co.—Bulletin 37E on fume collectors that eliminate harmful fumes, heat and smoke at their source.

198. Sellstrom Mfg. Co.—Bulletin 33-B on how new "Magna-Weld Plate" provides magnification for near vision that fits in any standard welding helmet.

199. Shawinigan Products Corp.—Information on carbide.

200. Shoot-A-Lite Corp.—Literature on safety gas lighter for welding and cutting torches.

201. Smith Corp., A. O.—Information on "SW-15" (E-6013) high-production mild steel electrodes.

202. Steel Sales Corp.—Information on new "Deoxo" flux for silver-brazing brass, bronze, copper, nickel-silver, steel, stainless steel, monel, nickel and inconel.

203. Stoody Co.—Name of nearest dealer and "The Stoody Guidebook" describes heavy equipment maintenance.

204. Stulz-Sickles Co.—Complete details and price list on "Manganal Wing Ding" individual slip-overs.

205. Superior Air Products Co.—Catalog describes single and double rectification plants and lists production data, shows flow charts and plant layouts.

206. Tee Torch Co., Inc.—Information on "Visuweld" torches for Tig welding.

207. Tempil Corp.—Information on, and sample pellets of, temperature indicators.

208. Tennessee Fabricating Co.—32-page catalog, "Everything For The Ornamental Iron Shop."

209. Tickle Engineering Works, Inc., Arthur—Brochure and complete details on "Alumicoat" applications for transition welding."

210. Titanium Alloy Mfg. Div.—Detailed literature on coating formulations with rutiles, titanates and zirconium compounds.

211. Tube Turns, Inc.—Booklet, "Pipe, Fitting and Flange Materials."

212. Tweco Products, Inc.—Catalog picturing complete line of arc welding accessories and "Tweco-Lite" aluminum arc welding cable.

213. United Wire & Supply Corp.—Details on how you can profit from automated brazing with "Phoson 6."

214. Van Vooren Products—Details on "Water-Mizer" water control unit.

215. Victor Equipment Co.—"Hardfacing Manual shows you right rod to use and how to apply it.

216. Victor Equipment Co.—Information on single and two-stage safety regulators.

217. Westinghouse Electric Corp.—Information on new custom "Silver W" a-c or d-c high-frequency welder with remote control.

218. Westinghouse Electric Corp.—Data on new "ZIP-14" universal powdered-iron electrode to fit both E6014 and E7014 classifications.

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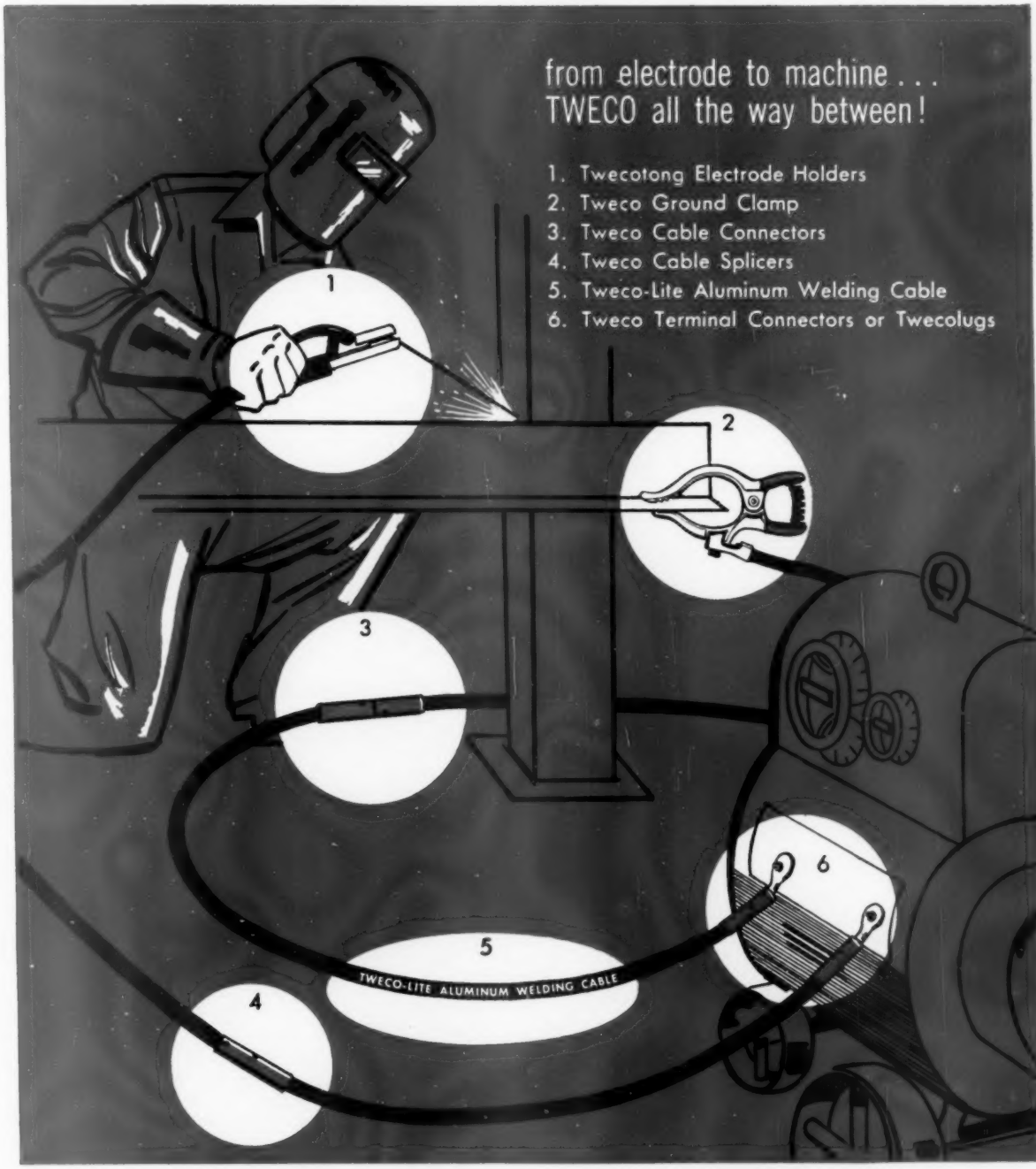
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250



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Write for FREE Catalog picturing complete line of Arc Welding Accessories and TWECO-LITE Aluminum Arc Welding Cable

Tweco

MANUFACTURERS: ARC WELDING ELECTRODE HOLDERS, GROUND CLAMPS, CABLE CONNECTORS, TWECO-LITE ALUMINUM WELDING CABLE

PRODUCTS, INC.

BOSTON AT MOSLEY • WICHITA, KANSAS, U.S.A.

This large carbon-molybdenum steel valve was a total loss unless a dozen or more internal cracks could be repaired. Job was done by welding with Inco-Rod "A" electrode.

Preheat was impossible . . . yet Inco-Rod "A" saved this valve for Consolidated Edison

At first, repairing this throttle valve looked like a real headache to the Welding Department of Consolidated Edison.

The casting is made of carbon-moly steel. In service, a dozen cracks . . . some 3 inches deep . . . had developed inside its 4-inch-thick wall.

Ordinarily this would not present too great a repair problem. Use a carbon-moly electrode. To prevent air-hardening of the weld metal, *be sure to preheat to 300°F.*

But that was the catch! The valve was too big for preheating . . . and weldors would have to work inside.

Fortunately, Thomas Reilly, General Foreman, knew about Inco-Rod "A"* electrode. (Even with Inco-Rod "A" electrode, preheating is recommended when required to protect some base metals, although it is not needed for the weld metal itself.) Since the valve was a total loss, anyway, he decided it was worth a try to salvage it with Inco-Rod "A" electrode.

Working without preheat, weldors built up welds in the cracks. In a few hours the valve was saved. And today it's performing perfectly . . . operating at 925°F. and 1250 psi.

If *you* want strong, sound joints whether in repair work or in production welding of dissimilar alloys . . . consider Inco-Rod "A" electrode. A helpful folder, just off the press, gives you data on many test welds made with this electrode . . . informative case histories, too. Write today for your copy.

A few of the cracks after welding.

Inco-Rod "A" electrode gives these advantages

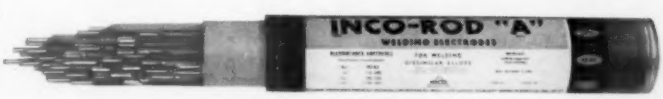
Versatility—This one electrode produces X-ray quality welds in *many* dissimilar alloy combinations: among ferritic and austenitic stainless steels . . . low alloy and mild steels . . . high-nickel, and other alloys.

Ease of use—With its spray-type arc, Inco-Rod "A" electrode is *easy*-handling in all positions. Slag removal is easy, too.

Corrosion resistance—Joints made with Inco-Rod "A". . . the electrode with the distinctive green flux coating . . . usually have equivalent or better corrosion-resistance than the alloys being welded.

*Registered trademark

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street New York 5, N. Y.

INCO-ROD "A" electrode is supplied in 14-inch lengths in four diameters, 3/32-, 1/8-, 5/32-, and 3/16-inch (the 3/32-inch is center grip) . . . packed in 5-lb. asphalt-lined containers.

INCO **Welding Products** • electrodes, wires, fluxes